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Annual Report

OF THE

AMERICAN INSTITUTE

OF

THE

City of New York

FOR THE YEARS

1866 & 7.

Albany.

Charles Van Benthuysen & Sons

1867

ANNUAL REPORT

OF THE

AMERICAN INSTITUTE,

OF THE

CITY OF NEW YORK,

FOR THE

YEAR 1866-67.

ALBANY:
VAN BENTHUYSEN & SONS' STEAM PRINTING HOUSE.
1867.

TABLE OF CONTENTS.

ILLUSTRATIONS.

AMERICAN INSTITUTE.

Trustees and Committees.

1867.

President—HORACE GREELEY.

Vice-Presidents—DUDLEY S. GREGORY, ORLANDO B. POTTER, WILLIAM H. VANDERBILT.

Recording Secretary—SALEM H. WALES.

Corresponding Secretary—SAMUEL D. TILLMAN.

Treasurer—SYLVESTER R. COMSTOCK.

Managers of the Fairs and Exhibitions—William H. Butler, Thomas McElrath, George Peyton, J. Groshen Herriot, Robert G. Hatfield, William S. Carpenter, Orestes Cleveland, Charles G. Halpine, William H. Hicks, J. Owen Rouse, C. Wager Hull, Thomas Hicks, Lloyd Aspinwall, Charles G. Smull, Nathan C. Ely, Davis Collamore, Lewis Feuchtwanger, James Knight, Frank Moore, J. Wilson Stratton, Charles K. Hawkes, Isaac Walton, George Francis Dawson, Samuel D. Tillman.

Committee on the Admission of Members—Charles E. Burd, Robert Lovett, John W. Chambers, John F. Cory, James H. Drake.

Committee on Finance—Thomas M. Adriance, Nathan C. Ely, Cyrus H. Loutrel, Thomas Williams, Jr., Charles Chamberlain.

Committee on the Library—James K. Campbell, Edward S. Renwick, Dubois D. Parmelee, William Swinton, Richard W. Bleecker.

Committee on Repository—James Bogardus, Albro Howell, Joseph Dixon, Nathaniel Wheeler, S. Starr Jocelyn.

Committee on Manufactures and Machinery—Warren Rowell, J. Wyatt Reid, Miers Coryell, George W. Quintard, Thomas D. Stetson.

Committee on Chemistry, Mineralogy and Geology—Charles A. Joy, Dubois D. Parmelee, Charles F. Chandler, Robert P. Stevens, J. S. Newberry.

Committee on Civil Engineering and Architecture—R. G. Hatfield, Leopold Eidlitz, Samuel McElroy, John W. Ritch, H. F. Walling.

Committee on Agriculture—John G. Bergen, P. T. Quinn, George Bartlett, Jonh Crane, S. Edwards Todd.

Committee on Horticulture—William S. Carpenter, John Henderson, Benjamin C. Townsend, Isaac Buchanan, James Hogg.

Committee on Commerce—John P. Veeder, Frank Moore, Jireh Bull, Luther B. Wyman, James H. Sackett.

Clerk and Librarian—John W. Chambers.

Messenger—Richard H. Dalton.

Faculty.

Samuel Dyer Tillman, M. A., Professor of Mechanical Philosophy and Technology.

Julius G. Pohlé, M. D., Professor of Analytical Chemistry.

Robert P. Stevens, M. D., Professor of Geology and Mineralogy.

Regents of the American Institute.

Edwin D. Morgan,	Hamilton Fish,
Gerrit Smith,	Henry W. Bellows,
Abiel A. Low,	Henry Ward Beecher,
Ezra Cornell,	William H. Appleton,
Cornelius Vanderbilt,	Orlando B. Potter,
Denning Duer,	John A. Griswold,
Samuel F. B. Morse,	Elias Howe, Jr.

State of New York.

No. 244.

IN ASSEMBLY,

April 5, 1867.

TRANSACTIONS OF THE AMERICAN INSTITUTE.

American Institute,
New York, *April 3d*, 1867.

To the Honorable the Speaker of the Assembly of the State of New York:

Sir—I herewith transmit the Annual Report of the American Institute of the City of New York for the year ending in April, 1867.

With great respect,

I have the honor to be,

Your obedient servant,

SAMUEL D. TILLMAN,

Corresponding Secretary.

COMMUNICATION TO THE LEGISLATURE.

To the Honorable the Legislature of the State of New York:

The undersigned respectfully submit to the Legislature, as a Report of the Transactions of the American Institute of the city of New York for the year ending in April, 1867, the annexed documents, containing :

1. A Review of the operations and condition of the Institute, presented by the Trustees at a meeting on the 7th day of February, 1867.

2. An Exhibit of the receipts and expenditures during the last fiscal year.

3. Reports of the several Standing Committees of the Institute.

4. Report of the Board of Managers relative to the Exhibition of Fruits, Flowers, and Vegetables, held on the 2d and 3d of October, 1866.

5. An Appeal to generous, patriotic citizens—especially those interested in the development and perfection of American Industry, presented by the President and adopted at a meeting of the Institute June 7th, 1866.

6. A report of the Trial of Horse Hay-Forks, held on the 4th and 5th of March, 1867.

7. A paper on "The need of an Institute which shall be National in its aims and influence, and the means required to place the American Institute in that position," adopted at a meeting of the Institute March 7th, 1867.

8. A Letter from Benj. C. Townsend, Esq., to the President of the Institute.

9. The proceedings of the Farmers' Club, including communications from all parts of the Union.

10. The discussions of the Polytechnic Association, relating chiefly to Technology; also embracing accounts of new Discoveries and Inventions.

11. An extract from the Code of Laws, adopted by the Institute May 3, 1866, in relation to the management of Annual Exhibitions, containing the permanent classification of articles to be exhibited, the manner of selecting judges on the merits of articles entered for competition, and the kind and number of prizes to be awarded to each class of exhibitors.

HORACE GREELEY, *President.*
D. S. GREGORY.
O. B. POTTER,
WM. H. VANDERBILT,
S. H. WALES,
S. R. COMSTOCK,
S. D. TILLMAN.

NEW YORK, *April* 3, 1867.

REPORT OF THE BOARD OF TRUSTEES.

The Board of Trustees of the American Institute submit the following report:

The authority conferred by the Institute to sell the Broadway and Leonard street property has not been used, inasmuch as no purchaser has been found willing to invest at the price which it is believed can be obtained for it. Shortly after the authorization was given, the Board agreed upon the sum of two hundred thousand dollars as the value of that property; and although offers have been made approximating to the amount fixed, it was deemed inexpedient and unadvisable to make any concessions whatever therefrom. Hence all negotiations for the sale of that property have ceased. These premises, however, have been rented for the term of one year from the first day of May next for the sum of twenty thousand dollars, with a privilege of extending the term two years longer at the annual rent of twenty-five thousand dollars, provided a notice of four months prior to the first of May, 1868, shall be given by the lessees to that effect.

By contrasting the amount secured to be paid for the coming year with the sum which the Institute is now receiving, it will be seen that the difference is an advance of one hundred and fifty per cent, and it is contemplated that from this source alone, in a comparatively short time, all liens will be removed with which that property is now encumbered.

The Board of Trustees cannot fail to express their great regrets that a building could not be obtained last autumn of sufficient capacity to hold a Fair. Much disappointment has been manifested by that class of citizens who are in sympathy with the annual exhibitions of the Institute. It is hoped that the importance attached to this branch of its operations will so stimulate the action of the Board of Managers in this behalf, that they will early resolve to overcome all obstacles which may obstruct their progress, and provide for an exhibition during the present year, even if it should

become necessary to erect temporary buildings on vacant lots obtained for that use to accomplish their purpose.

In consequence of this failure and by direction of the Institute, a free horticultural exhibition was held at its rooms on the 2d and 3d days of October last, under the direction of a committee appointed by the Board of Managers. The efforts of this committee were directed to a selection of the quality of the fruit to be exhibited, rather than to the quantity. These exertions were largely rewarded by a gathering of the choicest varieties of fruit rarely seen in public exhibitions, especially those of pears and grapes. At its close, the premium committee awarded the "Greeley" prize of one hundred dollars to the Concord grape.

By virtue of a resolution passed by the Institute March 20, 1866, the Corresponding Secretary was instructed to apply to the Legislature, then in session, for the passage of an act amendatory of our charter authorizing and appointing a Board of Regents, as custodians of such contributions as may be made in view of providing a permanent locality for securing sufficient accommodations for our annual exhibitions, and for other purposes. This application was eminently successful. That board now consists of the following named gentlemen:

Messrs. Edwin D. Morgan. Gerrit Smith, Abiel A. Low, Ezra Cornell, Hamilton Fish, Wm. H. Appleton, Elias Howe, jr., Cornelius Vanderbilt, Denning Duer, Samuel F. B. Morse, Henry W. Bellows, Henry Ward Beecher, Orlando B. Potter, John A. Griswold.

The Regents ex-officio are:

The Governor of the State of New York.

The Mayor of the city of New York.

The Secretary of the Interior of the United States.

The Trustees of the American Institute.

It is expected the board thus created will shortly be organized, whose efforts in conjunction with those of the Institute, it is hoped and believed, will accomplish all the objects contemplated by said amendment.

At a recent meeting of so many of the Regents as could be assembled together with the Trustees, it was decided that a grand exhibition of the products of American Industry and Art, in connection with a World's Fair, should be held in this city in the one hundredth year of American Independence, under the direction of the American Institute, commencing on the 4th day of July, 1876.

It is confidently hoped that an edifice worthy of such an exhibition will by that time be completed; so that, if not sooner, it may then be fitly inaugurated.

During the year the Institute, after long and patient deliberation, adopted a new code of by-laws, which seems to be well adapted to its enlarged sphere of operations, tending to promote harmony and efficiency, and at the same time to aid the members of the several standing committees in the discharge of the various duties which this code imposes.

The Board of Trustees refers with much pleasure and satisfaction to the report of the Agricultural Committee and Polytechnic Association.

If the valuable information disseminated by them in their weekly meetings were confined simply to their own members, it would richly compensate for the efforts put into execution to sustain these associations. But when it is remembered that their proceedings are published weekly, and receive a large and wide circulation, it is a matter of great congratulation that so many members of the Institute are found who freely devote their time and efforts to send broadcast throughout our country so large an amount of valuable and useful knowledge.

The other active standing committees will report the results of their operations, to which reference is made for a detailed view of all movemeuts of the Institute for the year now about closing. As one evidence of its prosperity, it seems proper to state that 260 new members have been received since the last annual report.

The volume of Transactions for 1865 and '6 has been received, and is ready for distribution to the members. It possesses the same high character of its late predecessors. It is worthy of recognition, that the last Legislature awarded to the Institute one thousand volumes, which is a much greater number than any previous edition.

The hope is indulged by the Trustees that the Institute will, at no distant day, inaugurate a series of lectures of a high order on scientific subjects for the benefit of the masses. Such a course will doubtless exert an influence of incalculable interest, and is recommended to the serious consideration of the Institute for its adoption.

In the progress of events, the time seems to have arrived when our Institute should vigorously strive to accomplish larger results than have heretofore been arrived at. Desiring encouragement

from the past, let us in this day of large things put forth such renewed efforts as will insure enlarged usefulness and success in the several fields of action in which our labors are employed, in the hope and expectation that the American Institute will not cease to exist until it shall have accomplished all the objects which its most ardent friends and advocates may desire, and to which a liberal and enlightened public may contribute.

Respectfully submitted,

HORACE GREELEY,
DUDLEY S. GREGORY,
EDWARD WALKER,
JIREH BULL,
S. D. TILLMAN,
S. R. COMSTOCK.

NEW YORK, *February* 7, 1867.

REPORT OF THE FINANCE COMMITTEE.

The Finance Committee of the American Institute beg leave to submit the following report of the receipts and expenditures for the year ending January 31, 1867 :

Balance in the treasury January 31, 1866			$1,276 14

Receipts.

Rent of premises No. 351 Broadway and No. 89½ Leonard street		$8,000 00	
Treasurer State of New York appropriation, 1865		950 00	
Managers of the thirty-sixth annual Fair,		788 85	
Admission fees and annual dues, viz :			
Life members	$935 00		
Admission fees	425 00		
Annual dues	716 00		
		2,076 00	
Certificates of awards		119 25	
Duplicate medals		13 00	
Sales of papers, &c		21 80	
Donation		10 00	
			11,978 90
			$13,255 04

Expenditures.

Taxes on real estate	$1,689 27
Assessment paving Broadway to Hudson st.,	50 41
Repairs	93 05
Insurance on real estate and library	177 75
Interest on bond and mortgage of $17,000,	1,088 50
Books, periodicals, and binding	326 40
Printing newspapers and advertising	228 32
Blank books and stationery	60 33
Gas	117 37

Rent of rooms in Cooper building	$1,687 50	
Filling certificates	46 88	
Reporting meetings of the Polytechnic Association	168 00	
Painting and covering tables	108 43	
Thirty-sixth annual Fair	742 50	
Special exhibition of fruit, flowers, &c	165 24	
Agent's expenses at Albany	47 00	
Sundry current expenses of the year	403 98	
Salary Corresponding Sec'y $1,500 00		
And appropriation for 1865 1,000 00		
	2,500 00	
Salary clerk and librarian	2,000 00	
Salary messenger	208 00	
		$11,908 93
Balance in the treasury January 31, 1867		$1,346 11

THOS. M. ADRIANCE,
THOMAS WILLIAMS, Jr.,
CHARLES CHAMBERLAIN,
CYRUS H. LOUTREL,
NATHAN C. ELY.

New York, *February* 2, 1867.

REPORT OF THE COMMITTEE ON AGRICULTURE.

The Committee on Agriculture of the American Institute beg leave to report:

That the Farmers' Club, which is under the direction of your committee, is increasing in interest, and the meetings are fully attended not only by the members of the Institute, but by farmers and horticulturists from various parts of the country. Some of the members come a distance of from twenty to thirty miles every week to attend these discussions.

The immense number of letters which are daily received from every part of our country, testify to the hold the Farmers' Club has on the minds of the people. These letters, asking for information on a variety of subjects connected with agricultural purposes, are briefly answered by the members present, which often leads to extended debates.

Applications are being constantly made to the club to appoint committees to examine new improvements in agricultural implements and machinery. Such machinery when exhibited in practical operation is more satisfactory than looking at models or drawings. At nearly every meeting of the club new inventions in labor-saving machinery are brought to the notice of the members and the public. During the past summer, a committee of the club visited the strawberry exhibition at Hammonton, N. J., and had a full opportunity of seeing the improvements in that growing settlement. On the 1st of August, a committee visited Newton, Sussex county, N. J., for the purpose of examining the Kittatinny blackberry. On the arrival of the committee at Newton, notice was given that the Farmers' Club would hold a meeting in the evening, which was well attended by the inhabitants of Newton, and by a number of eminent horticulturists from different States, who were present to examine this new variety of blackberry. The discussion was kept up to a late hour, and was a perfect success. The reports of the meeting were published in a number of the agricultural papers.

The committee have been very fortunate in the selection of a chairman, Mr. Nathan C. Ely, who has devoted considerable time during the last three years in presiding over the meetings of the club. The distribution of seed, &c., commenced some years ago, has greatly increased during the last two years. Mr. Chambers, the Secretary, has received during the last year over 12,000 letters from persons asking for seed—all have been supplied.

Mr. James B. Olcott last year sent to the club a barrel of Rhode Island sweet corn for gratuitous distribution. This corn was of a very superior quality. From the notice given in one of the reports of the club, the applications were so numerous that a large number had to lay over for the want of the corn to send. Mr. Olcott, on being informed of the fact, sent to the club this winter two barrels more of the same variety. By means of this donation, all the applicants have been supplied. This duty has consumed much time, but has been cheerfully attended to by our Secretary.

The great notoriety given to the proceedings of the club is eminently due to the veteran agricultural editor of *The Tribune*, Mr. Solon Robinson, who, for the past seventeen years, has so ably reported the discussions, and we hope his valuable services may be long continued. An able corps of reporters now attend the meetings of the club, whose reports are published weekly in a number of leading papers.

All of which is respectfully submitted,

JOHN G. BERGEN,
P. T. QUINN,
GEORGE BARTLETT,

REPORT

OF THE COMMITTEE ON HORTICULTURE, 1867.

The Committee on Horticulture respectfully report:

That during the last year a creditable exhibition of fruit, flowers and vegetables was held in the rooms of the Institute. Many new and improved varieties of grapes, pears, apples, and vegetables were shown for the first time at this exhibition. The specimens of fruit from Vineland, N. J., attracted much attention. Duchesse d'Angouleme pears, weighing near two pounds, enormous apples, and well-ripened grapes, were exhibited from that newly-cultivated land, which is now so full of promise to the fruit grower.

We desire to see these exhibitions encouraged by the American Institute. Boston, Philadelphia, and many other cities in the Northern States give substantial aid to horticultural exhibitions, which are held monthly, thereby encouraging a greater supply of improved fruits and vegetables.

The great importance of the subject to the inhabitants of this city should awaken in our members a disposition to provide liberal accommodations, so that the professional and amateur horticulturist may meet together to exhibit and compare the products of the garden and orchard, and give to thousands of our citizens an opportunity to see the new and progressive seedlings of fruit, flowers, and vegetables, which have been produced by so much science and skill.

When a new fruit, flower, or vegetable is to be produced, an expert, with a delicate camel's hair brush, transfers the minute particles of the pollen of one flower to the pistil of the one that is to become the parent of the new seedling. Thus the pollen of the flower of the Black Hamburg grape is transferred to the pistil of some of the flowers of a hardy and thrifty native grape, and the result of this union is a hybrid grape, hardy and improved. It is the result of these experiments that make our exhibitions more deeply interesting and instructive.

Your committee are encouraged in the belief that the time is shortly coming when horticulture will be inseparable with the other great interests of the American Institute.

We had hoped to revive within the last year those pleasant meetings, discussions, and lectures, which brought together such spirits as Beecher, Bancroft, Greeley, Osgood, and others.

The happy influence of horticulture is not confined to a household, but its influence extends to neighborhoods, communities, and to nations.

Our worthy President, by a magnanimous act, has gladdened the hearts of the inmates of many a cottage, who will engrave in tens of thousands of the vines of the Concord grape the name of Horace Greeley.

We trust that the American Institute will spread out its wings so that this branch of industry—this civilizer of the world—may find a permanent home within its borders.

WM. S. CARPENTER,
P. T. QUINN,
B. C. TOWNSEND, } *Committee.*

NEW YORK, *February* 7, 1867.

REPORT

OF THE COMMITTEE ON MANUFACTURES, SCIENCE, AND ART OF THE AMERICAN INSTITUTE.

The Committee on Manufactures, Science, and Art respectfully report:

During the past year, the several inventions referred to your committee have been carefully examined, and each has been made the subject of a special report. The number of novelties submitted to them has not been great, and this is accounted for by the fact that at the weekly meetings of the Polytechnic Association and of the Farmers' Club an opportunity is always given for inventors to explain their own devices, which are generally briefly described in some of the reports of these meetings in the city journals. Inventors who do not reside in New York find it most convenient to attend such meetings; and their aim, generally, being to give immediate publicity to their productions, they seldom desire to submit to the delay consequent upon a regular reference by the Institute to your committee, who are required to notice every defect as well as merit in the machine or process under examination.

The Polytechnic Association, under the especial charge of your committee, was organized for the year by the reappointment of the chairman and secretary of the previous year. Its provision for free discussions on all subjects appertaining to science and art, in which those who are not members of the Institute may participate, has been productive of the happiest results. An objection has been raised to giving the privilege of speaking to a promiscuous assemblage, which may sometimes lower the dignity of a scientific debate; but while the organization is really under the direct control of the members of the Institute, and the presiding officer is fully empowered to preserve order, this objection cannot be said to outweigh the great advantage of extending to all an opportunity of presenting the results of reflection, practice, and

experiment, which are often found worthy of a place in the annual volume of Transactions.

The usual practice of giving at each meeting a condensed account of the progress of Invention, Discovery, and improvement in the useful arts throughout the world, is continued by the chairman. This scientific summary forms a prominent feature in our annual report, and makes it more valuable as a book of reference. During the past year, the Polytechnic has departed somewhat from its usual course in entertaining some questions of a purely theoretical and speculative character relating chiefly to Cosmogany. Some able papers have been read on abstract themes, which seem to have drawn larger audiences than discussions of a more practical bearing.

The large and increasing attendance at these meetings, where many are often unable to procure seats, prompt your committee to suggest that they should be held in a larger, more convenient, and better ventilated room. The occasional occupation of a place which is used at other times for meetings of a very different character, and which belongs to and is controlled by another institution, tends to lessen the influence which the Polytechnic as well as the Farmers' Club would otherwise exert. If the American Institute is not yet in a condition to erect such a magnificent structure as will be commensurate with all its wants, it certainly has the means for providing one commodious hall to be devoted exclusively to its own use, and that of its several branches.

All of which is respectfully submitted,

JOHN D. WARD,
JAS. DIXON,
SAMUEL D. TILLMAN.

NEW YORK, *February* 7, 1867.

DR. ROWELL'S VALVE FOR STEAM ENGINES.

The Committee on Manufactures, Science and Art, to whom was referred W. Rowell's valve for steam engines, respectfully report:

A wood and glass model of this valve was shown to your committee. It is not a balanced valve according to the common acceptation of that term, but is called by the inventor a pressureless valve. Its novelty consists in arranging two similar rectangular slide-valves on the perpendicular opposite sides of a double

valve seat having steam passages leading diagonally to the steam ports. The vertical valves are kept at a fixed distance apart by two horizontal studs, whose length is precisely the interval between the face of the valve-seats, and whose centres are on a line drawn lengthwise through the middle of each valve. The steam enters the cylinder from both sides of the studs, and the exhaust passes through the valves and into one exhaust passage.

The inventor claims that his valve is well adapted to engines of great power in which very large valves are necessarily employed. He further claims that the studs in his arrangement prevent any great wear of the valves on the seat. but should this occur the studs are to be lessened in length so that the valves will just touch their seats. The inventor further states that he intends to construct these valves, studs and valve-seats of homogeneous metal, thereby preventing an unequal expansion of parts by heat.

A very serious query is, whether, in case the valves are slightly loosened by wear the steam will not all escape through one valve, thus making the other valve do all the work, and that under the whole pressure of the steam. Another questionable point is the actual wear of the valve-seat by making a permanent connection between the valves and balancing their faces. Were the pressure of steam the same in every part of the apparatus, this provision would be ample.

The actual value of the new valve can only be determined by practical use. Your committee deem it worthy of trial, and will be glad to learn that the inventor has obviated the objections now made.

Respectfully submitted,
JOHN D. WARD,
JOSEPH DIXON,
SAMUEL D. TILLMAN,

NEW YORK, *February 7th*, 1867.

THE AMSDEN HYDROSTATIC SCALE.

The Committee on Manufactures, Science and Art, to which was referred Amsden's Hydrostatic Scale, report:

That they examined the model and heard the explanations presented, and are of opinion that although the indications of the apparatus are correct so long as the conditions remain the same,

it appears to them that if it applied to canal boats of large dimensions the indications upon the index or scale produced by moderate additions to the cargo, will not be affected to such an extent as to enable ordinary observers to ascertain the weight with any considerable degree of accuracy. If a tolerable approximation to the weight of a cargo is all that is required, the scale may be useful, as it is easily applied, and requires little time or labor to read its indications.

Respectfully submitted,

JOHN D. WARD,
JOSEPH DIXON,
SAMUEL D. TILLMAN,

NEW YORK, *February 6th*, 1867.

REPORT

OF THE COMMITTEE ON THE ADMISSION OF MEMBERS.

The committee on the admission of members, in conformity to section 1, article 11, of the by-laws, beg leave to submit the following report of their proceedings for the past year:

The year just closed has been one of great activity as regards the admission of new members. In no one year has there been so great a number of persons admitted as members of the American Institute. The new candidates are of that class which is calculated to strengthen the Institute, thanks to the members for the interest taken by them in bringing forward so many new names for membership; and, judging from the past, the present year will witness a still greater addition to our number. And it is to be hoped in our zeal as members to bring forward new candidates, we will not lose sight of the fact that the character and standing of candidates proposed will be of more importance to the Institute than mere numbers, so that the new life infused will make the Institute shine as bright in the future as in the past.

The committee have acted and reported formally on the names of candidates for membership at each stated meeting. The names, occupations, and residences of the several candidates, with the names of the members who proposed and endorsed them, were duly presented. The numbers admitted monthly were as follows:

1866.		
February	20	88
March	13	23
March	20	20
May	3	26
June	7	16
September	6	18
October	4	9
November	1	5
December	6	25
1867.		
January	3	10
February	7	20
Total		260

The reports were accepted and the candidates duly elected members of the Institute.

The following is the total number of members belonging to the Institute:

Honorary		83
Corresponding		245
Life	1,059	
Less deceased	184	875
Annual		805
		2,008

All of which is respectfully submitted,

CHARLES E. BURD,
JOHN W. CHAMBERS,
JAMES H. DRAKE,
JOHN F. CORY,
Committee.

NEW YORK, *February* 7, 1867.

REPORT OF THE BOARD OF MANAGERS.

The Board of Managers of the Fair, respectfully report:

That in obedience to the following resolution, passed at a regular meeting of the Institute, held on the 6th day of September last, viz:

"*Resolved*, That in consequence of the Board of Managers not being able to hold a general Fair during the present autumn, the Institute hereby authorizes and directs that a Special Exhibition of Fruits, Flowers and Vegetables, be held in the rooms of the Institute, during a portion of the month of October next, and that a sum not exceeding three hundred dollars be, and is hereby appropriated for the purpose of defraying the necessary expenses of such exhibition."

The Board of Managers held the exhibition in the rooms of the Institute, on Tuesday and Wednesday, the 2d and 3d days of October. They have the pleasure to state that, considering the limited time allowed them, the exhibition was a very creditable one. There were 51 contributions, coming from the States of Massachusetts, Connecticut, New York, New Jersey and Pennsylvania.

The show of fruit was very large, embracing many of the choicest varieties. The specimens of corn and potatoes were very interesting; many new varieties were shown for the first time, among these were eleven new varieties of potatoes originated by Mr. Patterson of London, exhibited by Mr. Wm. S. Carpenter; also a collection of Goodrich seedlings exhibited by Mr. Carpenter and Messrs. Reisig and Hexamer of Westchester county.

The exhibition of plants embraced a very rare collection of palms and a choice assortment of orchids in bloom, these were from the green house of Mr. Buchanan, one of the members of the board; another member, Mr. James Hogg, contributed some plants of the Japanese sugar cane, and Japanese buckwheat.

The rooms, during the two days and evenings, were thronged by the members of the Institute, and their families, and strangers, the exhibition being free.

The Board of Managers awarded 49 premiums, amounting to $112; the extra expenses incurred for printing, advertising, fitting up the rooms, attendance, labor, &c., was $53.24—making the whole cost of the exhibition $165.24.

Annexed will be found the list of premiums awarded and a detailed account of the expenses incurred.

All of which is respectfully submitted.

New York, *Feb.*, 1866.

WM. EBBITT,
NATHAN C. ELY,
JAMES KNIGHT,
JAMES HOGG,
J. GROSHON HERRIOT,
W. H. BUTLER,
R. G. HATFIELD,
CHAS. A. WHITNEY,
CHAS. WAGER HULL,
G. M. WOODWARD,
ISAAC BUCHANAN,
THOS. F. DE VOE,
GEORGE TIMPSON,

PREMIUMS

AWARDED AT THE SPECIAL EXHIBITION OF FRUIT, FLOWERS, VEGETABLES, &c., HELD AT THE ROOMS OF THE AMERICAN INSTITUTE, OCTOBER 2d AND 3d, 1866.

FRUIT.

Apples.

Wm. E. Waring, Throg's Neck, Westchester county, N. Y., for the best Baldwin apples	$2
W. H. Goldsmith, Waverly, N. J., for the best Northern Spy apples	2
Wm. F. Waring, Throg's Neck, N. Y., for the best Hubbardston Nonsuch apples	2
O. S. Hathaway, Newburgh, N. Y., for the best Newtown Pippin apples	2
E. Williams, Montclair, N. J., for the best Fall Pippin apples,	2
O. S. Hathaway, Newburgh, N. Y., for the best Rhode Island Greening apples	2
Wm. L. Ferris, Throg's Neck, N. Y., for the best Spitzenburg apples	2

Pears.

H. Z. Ellis, Vineland, N. J., for the best Duchesse d'Angouleme pears	$2
H. Z. Ellis, Vineland, N. J., for the best Louise Bonne de Jersey pears	2
Spencer Springstead, Union Port, N. Y., for the best Beurré Diel pears	2
Marc & Witham, Astoria, L. I., for the best Seckel pears	2
Wm. L. Ferris, Throg's Neck, N. Y., for the best Sheldon pears	2
E. Williams, Montclair, N. J., for the best Beurré Clairgeau pears	2
Marc & Witham, Astoria, L. I., for the best Beurré Bosc pears	2

Spencer Springstead, Union Port, N. Y., for the best Urbaniste pears	$2
Spencer Springstead, Union Port, N. Y., for the best Lawrence pears	2
Wm. L. Ferris, Throg's Neck, N. Y., for the best Beurré D'Angou pears	2
Wm. L. Ferris, Throg's Neck, N. Y., for the best Dana's Hovey pears	2

GRAPES.

H. Z. Ellis, Vineland, N. J., for the best Catawba grapes	$2
R. T. Underhill, Croton Point, N. Y., for the best Isabella grapes	2
O. J. Tillson, Highland, N. Y., for the best Concord grapes	2
R. T. Underhill, Croton Point, N. Y., for the best Diana grapes	2
R. W. Holton, Haverstraw, N. Y., for the best Iona grapes	2

VEGETABLES.

W. H. Goldsmith, Waverly, N. J., for the best early Goodrich potatoes	$2
W. H. Goldsmith, Waverly, N. J., for the best winter potatoes	2
Reisig & Hexamer, Newcastle, N. Y., for the best Cuzco white potatoes	2
Reisig & Hexamer, Newcastle, N. Y., for the best white Peach Blow potatoes	2
D. A. Bulkley, Stone Hill Farm, Williamstown, Mass., for the best Bulkley seedling potatoes	2
Reisig & Hexamer, Newcastle, N. Y., for the best Rustycoat potatoes	2
Spencer Springstead, Union Port, N. Y., for the best Long Orange carrots	2
James Brown, Clifton, N. J., for two Custard squashes	1
David J. Tyson, New Dorp, L. I., for Fegee tomatoes	1
David J. Tyson, New Dorp, L. I., for a very large egg plant,	1
Henderson & Fleming, 67 Nassau street, for a fine collection of fancy gourds	2

GRAIN.

James Brown, Clifton, N. J., for the best 6 ears of white corn	$1
H. Z. Ellis, Vineland, N. J., for the best 6 ears of yellow corn	1

Spencer Springstead, Union Port, N. Y., for the best 6 ears of sweet corn.......... $1

O. J. Tillson, Highland, N. Y., for the best peck of white rye.......... 3

Flowers.

Peter Henderson, Bergen, N. J., for the best verbenas..... 2

A. G. Burgess, East New York, L. I., for the best 12 dahlias, 3

Wm. C. Wilson, Astoria, L. I., for the best basket of flowers, 5

Wm. C. Wilson, Astoria, L. I., for the best hand bouquet.. 3

They would also make honorable mention of a collection of beautiful and rare orchids and palms, exhibited by Mr. Isaac Buchanan, Astoria, L. I., and to a collection of dahlias and other flowers, exhibited by Mr. Wm. S. Carpenter, Mr. C. S. Pell and Mr. Peter Henderson.

Special.

Ferris & Caywood, Poughkeepsie, N. Y., for the "Walter grape," a special premium.......... $5

In the judgment of the Committee, it is a very promising new grape, and they feel it will prove a very valuable acquisition to the best of choice grapes. It compares favorably with our best grapes.

Wm. L. Ferris, Throg's Neck, N. Y., for a large collection of pears and apples.......... $10

O. S. Hathaway, Newburgh, N. Y., for a fine collection of apples.......... 5

Solon Robinson, East Yonkers, N. Y., for a collection of fruit as they grew.......... 2

H. Z. Ellis, Vineland, N. J., for a collection of apples, pears and quinces.......... 5

E. Ware Sylvester, Lyons, Wayne county, N. Y., for a seedling apple.......... 1

John G. Bergen, Gowanus, L. I., special notice for a fine collection of 14 varieties of pears.

Wm. S. Carpenter, Harrison, N. Y., exhibited 25 varieties of apples, and 50 varieties of pears. The Committee take pleasure in giving the collection of choice fruit special notice.

Mr. C. also exhibited 11 varieties of Paterson's seedling potatoes, the first time shown in this country, also 8 varieties of Good rich seedlings, very fine.

EXPENDITURES.

Printing circular and cards		$17 10
Postage stamps		3 29
Cartage, table tops, &c		3 50
Paper for covering tables		3 00
Gum labels, 4 boxes		50
Advertising, N. Y. Times	$4 20	
N. Y. Tribune	3 50	
		7 70
Labor and attendance		9 00
Cleaning, &c		7 50
Express charges		1 65
		$53 24
Premiums, amount awarded, viz:		
Apples	$14 00	
Pears	22 00	
Grapes	10 00	
Vegetables	19 00	
Grain	6 00	
Flowers	13 00	
Special	28 00	
		112 00
		$165 24

APPEAL

TO GENEROUS, PATRIOTIC CITIZENS, ESPECIALLY TO THOSE INTERESTED IN THE DEVELOPMENT AND PERFECTION OF AMERICAN INDUSTRY.

The American Institute, founded in 1829, was the first in the world to establish annual fairs for the promotion of improvement in the various branches of productive industry, more especially in mechanics and manufactures. These fairs it has maintained, with very few intermissions, for a period of nearly forty years, growing steadily in extent and importance, exciting many imitations.

The Institute has awarded and paid to American inventors and artisans, at the close of thirty-six fairs respectively, premiums costing over $100,000. None will dispute that its awards and commendations, with the emulation they necessarily incited, have contributed somewhat to the improvement of methods and the increase of efficiency in our National Industry.

The Institute is now brought to a pause in its useful career by the fact that no structure remains in our city wherein such fairs as befit the present development of American Industry can be held. The time has passed wherein such a fair could be held in a single spacious saloon like our old Masonic Hall. The Crystal Palace was destroyed by a fire which consumed all the capital of the Association which erected it. The "Palace Garden," wherein our fairs have more recently been held, has been converted to uses incompatible with its re-occupation by us. We are willing to pay a large price for the use of a suitable edifice wherein to hold our Thirty-seventh Fair next autumn; but no such edifice is to be had at any price.

The American Institute needs and deserves a "local habitation," having already achieved a "name." After having been so long hunted from pillar to post—now depending on municipal indulgence, then trusting to the chance of finding some unfinished or deserted building wherein to display the trophies of American genius and skill—it ought to have a permanent home. Its forty

years of wandering should by this time have brought it within sight of the Promised Land.

We need and seek an edifice wholly consecrated to American Industry, and not unworthy to be pointed out and recognized as its focus and rallying point. We need an edifice which every inventor, artificer, and artisan who visits our city will regard with affectionate interest, and whence he will bear away a manlier pride in his vocation. We need an edifice wherein we can repay, on occasion, some part of the hospitality which we have hitherto been constrained to invoke.

Among the objects to be attained in the construction of such an edifice, are the following:

1. Annual Fairs, as hitherto, but on a larger scale, with better adaptations for the exhibition of machinery in motion and improvements in motive power.

2. A permanent exhibition of the most valuable, beneficent inventions, with reduced models of those of secondary worth.

3. A Gallery of Industrial Art, with such a Library of Scientific Works as has never yet been collected in this country.

4. A Grand Lecture Hall, to be devoted to the increase and diffusion of useful knowledge, with especial reference to Productive Forces, Social Science, and Industrial Progress.

Such an edifice will cover a block of ground in the most central part of our city, and should cost, when completed and fitted up, not less than One Million of Dollars. Of this amount, we have about $150,000 well invested—the savings of many years of patient thrift and frugality. We ask the generous and public spirited to make up the residue by voluntary contributions in aid of the cause whereof we are but the servants.

Hitherto, we have been embarrassed by the fact that prudent men hesitated to give to a voluntary association whereby their means might be squandered. Our late Legislature obviated this difficulty by "An act to Amend and Enlarge the Powers of the American Institute," which names fourteen citizens of great wealth and high character, to constitute, in connection with the Secretary of the Interior, the Governor of our State, the Mayor of our City, and our (seven) Trustees, a Board of Regents, and provides that "All donations, bequests, and devises hereafter made or given to the American Institute, shall be taken or held by the said Board of Regents in trust for said Institute." Hence, it will be impossi-

ble that any such donations should be embezzled, misappropriated, or wasted.

We offer, then, our own $150,000 toward the erection of such an edifice as the interests of American Industry imperatively require. We most respectfully solicit of you such contributions as your means will warrant and the object may seem to you to deserve. No dollar will be diverted or lost; all will be devoted to the erection of an edifice which shall honor our City and State, while it insures a more rapid progress in Science and the Useful Arts throughout our country and the world.

Any suggestion or word of encouragement from you will be gratefully received and considered by Yours,

HORACE GREELEY, *President.*

Trustees.

DUDLEY S. GREGORY,	JIREH BULL,
WILLIAM HIBBARD,	SAMUEL D. TILLMAN,
EDWARD WALKER,	SYLVESTER R. COMSTOCK.

[The above appeal was unanimously adopted at a regular meeting of the Institute, held on the 7th day of June, 1866.]

TRIAL OF HORSE HAY-FORKS.

A trial of Horse Hay-Forks was held on the 4th and 5th of March, 1867, by order of the Board of Managers, and under the direction of a committee selected by the Farmers' Club, consisting of S. Edwards Todd, Wm. S. Carpenter, P. T. Quinn, David M. Smith, Josiah H. Macy and Wm. H. Smith. The place of trial was the commodious barn of Mr. Josiah Macy, in the town of Harrison, Westchester county, about one mile west of Rye Station, on the New York and New Haven railway—who not only supplied teams for drawing hay from the field, but provided a delicious and substantial repast for all the members of the Club in attendance on each day. The following is a list of entries, and brief account of the test of sixteen implements:

C. C. Blodgett, Watertown, Jefferson county, N. Y, entered a round harpoon, "Cat's Claw Fork." This was worked with a yoke of oxen, and pitched off 1,500 pounds of hay in nine minutes and thirty seconds.

The "Improved Hay Knife and Fork," was entered by George B. Davidson, Troy, Penn; removed 1,607 pounds of hay over the large beam in nine minutes and forty-five seconds.

"Sprout's Hay Fork and Knife," entered by S. E. and L. B. Sprout, Muncy, Lycoming county, Penn.; pitched off 1,850 pounds of hay, over the large beam, in five minutes and fifty seconds. This was worked with a yoke of oxen.

"Ames' Plow Company Harpoon Fork," commenced pitching, and failing to operate satisfactorily, was removed.

A large grappling fork was entered by John H. Chapman, Utica, N. Y., which performed its work beautifully; has three long tines to each head, and was attached to a small car running on a railway constructed close in the peak of the barn. This car was so constructed that when the forkful had risen nearly to the top of the barn, directly over the load, the fastening is released automatically and the load moves off horizontally to the furthest part of the mow, as rapidly as a horse can walk. In this instance

the hay was carried at pleasure to the first, second or third bay. This fork unloaded 2,180 pounds at thirteen forkfuls, in twelve minutes, when worked with one light horse.

"Reynolds' Union Fork," entered by R. Reynolds, Stockport, N. Y., was a three-tined grappling fork, having one tine on one side and two on the other side. This was tried with one horse, and pitched off 2,050 pounds of hay, at thirty-two forkfuls, in twenty-one minutes.

L. L. Johnson, North Chatham, N. J., commenced pitching with a two-tined grappling fork, and breaking some important part of it, retired.

"Brown's Improved Fork" was entered by J. S. Brown, Washington, D. C. This fork did not succeed in removing its load.

"The Excelsior Palmer Fork," having only one head and sickle tines, was entered by Palmer & Wackerhagen, Hudson, N. Y. This is an independent fork, with a short handle, about two feet long. The fork is tipped by having the rope attached to a knee-joint, similar to the joint attached to a carriage-top. This pitched 1,830 pounds of hay, over the large beam of the barn, in eight minutes and five seconds. It was worked by a yoke of oxen.

"The Farmers' Friend," entered by C. N. Culver, Bowling Green, Wood county, Ohio, was an iron grappling-fork, with two tines in each head. It pitched off its load in nine minutes.

M. E. Plumm, Munson, Fairfield co., Conn., entered a one-sided fork, the head of which was nearly six feet long, of wood three inches square, and provided with six tines.

"Buckman's Grappling Fork," entered by Abram Requa, New York city, is a double-headed, three-tined, iron grappling fork, which possesses points of superiority for certain purposes that are not claimed by the proprietors of any other fork. There is a system of levers by which the points of the tines, as the fork begins to grapple its load, are elevated, for the purpose of holding the forkful more securely, than if the tines stood at a more obtuse angle with the bale. The proprietors claimed that they could pitch more sheaves of grain, more loose straw, short rowen, seed clover, or a larger number of bundles of straw, or corn-stalks, and a larger heap of long manure, than could be done with any other fork. In addition to all this, they remove the hay tines, and attach a set of grappling hooks, with which barrels, boxes, and any other heavy material can be handled, which other forks can not move. The fork is all iron, and exceedingly strong.

"Rogers' Harpoon Fork" was entered by D. B. Rogers, Pittsburgh, Penn. The harpoon fork threw out two claws made of steel, in the form of a cat's claw, near the lower end of the fork, which lifted the forkful of hay. The fork pitched off 1,382 lbs. of hay in eight minutes.

A. M. Halstead, New York city, entered "Halstead's Hay Fork," which is a two-tined iron fork, and the committee seemed favorably impressed with the appearance of this little cheap and good fork; but, through some mismanagement, one tine was injured so that the fork could not be used to remove the remainder of the load.

A "Case Harpoon Fork" was entered by E. Sharkley, Lewisburgh, Penn. The chief point of superiority in this fork consisted in its self-adjustability, when being drawn back to the load, by which the sharp point is held away from the operator on the load.

"Walker's Improved Harpoon Fork" was entered by Wheeler, Melick & Co., Albany, N. Y. This fork consists of two parallel bars of steel working closely together, having a hinged point attached to the end of one bar. After it is thrust into the hay, the point is turned to a right angle, for holding the hay. It was estimated that this fork removed the heaviest forkful of all those exhibited.

We failed to get all the figures representing the weight of hay pitched, and the time required to remove the loads. But that is of trivial importance, as most of those who worked the forks were novices at that kind of labor, and unable to display the ability of the inventions.

After the last fork had been tested, W. S. Carpenter called the crowd to order, and introduced the chairman of the committee, S. Edwards Todd, who said to them: "It affords me pleasure to say to you that in our adjudication of the forks tested here, this committee have aimed to be actuated by principles of the greatest possible fairness and the strictest equity. In making up our decision as to the merits and demerits of the various forks exhibited, we shall not be influenced by fear, favor or compromise. We are sworn attorneys for the toil-worn farmer. We do not desire to denounce any manufacturer's fork, but we shall aim to point out to the inquirer for labor-saving implements, the most efficient labor-saving fork in our country. You cannot all have the first premium, although almost every fork here to-day has operated admirably. But I trust that when this committee come

to compare each fork with the points of excellence which they have chosen for their standard of merit, none of you will accuse us of unfairness and partiality, for we shall aim to render such a report of this trial next week as will reflect great credit on inventors and manufacturers of horse hay-forks.

On Tuesday, March the 12th, Mr. Todd, in behalf of the committee, made the following report to the Farmers' Club :

Preliminary Suggestions.

Practical farmers are employing horse hay-forks, in a great variety of ways, to save manual labor. Most of them appreciate and fully understand the importance of having a fork with which a horse can perform this kind of drudgery with facility and dispatch. In the grain-growing regions of our country the entire barley crop is harvested without binding a sheaf of the straw. Those farmers, therefore, who have raised barley know the value of a horse-fork that will pitch a large forkful of barley straw, either before the grain is threshed out or after the straw has been passed through a threshing machine, as the straw of no other cereal grain is so slippery and difficult to pitch as barley straw. In numerous instances the oat crop is harvested without binding the straw, which is also slippery and exceedingly difficult to pitch both before the grain is threshed out and afterwards. Rowen and red clover, when the crop is saved for seed, are among the most difficult substances that farmers desire to pitch, as the stalks are short, sometimes slippery, and will not hang together like the haulm of flax or long hay. Horse-forks are also being employed to a great extent every season for pitching coarse barnyard manure and for the purpose of forking over compost-heaps, and particularly for "heaping" or piling coarse manure when it is to remain in the yard for several months to come. By means of horse-forks, many farmers have learned that their horses, which have heretofore been accustomed to stand idle, can relieve them of a large portion of this heavy labor. In many instances, horse-forks are employed to pitch sheaves of heavy corn-stalks, or sheaves of grain, or bundles of straw on to high mows or stacks. These brief suggestions will enable the committee to understand the true character of the operations to be performed by a horse-fork, and also to decide upon certain points of excellence indicating the relative standard of merit possessed by the forks to be tested.

Classification of Forks.

The committee thought it most expedient to arrange the forks into two classes. The first class embraces those that elevate the material to be pitched by grappling it. The second class comprehends those forks that operate on the harpoon principle—by thrusting the implement straight into the hay or straw, holding their load by means of flukes, square shoulders in the sides of the blades, or by spurs or claws thrust out laterally into the hay. Most of the first class of forks are adapted to pitching anything and everything that any farmer desires to handle with a horse fork. In the second class, those of forks only are arranged that are simply designed for handling hay and straw. Therefore, if a farmer wants a fork for pitching hay only, a fork like Blodgett's round harpoon fork will give him the best satisfaction. But if he desires to remove hay from his mows or stacks in square blocks, without picking it apart, one similar to Sprout's combined knife and fork will subserve a better purpose, as with this implement the mow can be cut into squares containing one or two hundred pounds of hay each, lifted bodily with the knife and placed on the load. This mode of moving hay is worthy of recommendation, as hay will waste much less when taken out in solid squares than when pulled apart in the usual manner.

Points of Merit.

Although the following points of merit were chosen by the committee, for the purpose of testing the forks entered at the trial, still they were not able to make a satisfactory record opposite point No. 13, touching the time required to unload a ton of hay, as most of the men who managed the forks did not possess the necessary experience and skill for working a fork to its greatest ability. The committee perceived that if some of the forks could have been in the hands of farmers who are accustomed to handle such implements, they would have accomplished their assigned task in half the recorded time. They therefore feel it their duty, in justice to inventors and manufacturers, to attribute the failure of certain forks, in time, to want of skill and expertness on the part of the man who worked the implement, rather than to any imperfection of the fork.

The points of merit are herewith given :

1. The ease with which the fork is handled and loaded.
2. The ease with which the fork lifts its load from the cart.

3. The quantity of hay each fork takes at a time.

4. Does the fork grapple more hay than it can lift?

5. Does the fork carry its load to the mow without dropping a portion of the hay?

6. The ability of the fork to distribute the hay on the mow.

7. The ease with which the fork is unloaded.

8. The space required for the fork to work in.

9. The ability of the fork to deliver its load through a window or door.

10. Is the fork liable to drop its load when coming in contact with an obstacle?

11. Does the fork drop the hay on the mow in good condition, without rolling it up?

12. The ability of the fork to take up the hay clean from the cart.

13. The time required to unload a ton of hay.

14. The ability of the fork to pitch coarse manure.

15. The ability of the fork to pitch loose oats, barley, seed clover, wheat, rye straw, bundles of straw of any kind, and stalks of Indian corn.

16. The ability of the fork to take up coarse and fine hay.

17. Are the operators liable to injury when working the fork?

18. The simplicity of the fork.

19. The strength and durability of the fork.

20. The cost of fork, pulleys and ropes completed.

List of Awards.

The first award to class No. 1 was given to "Palmer's Excelsior Sickle-tined Fork," entered by Palmer & Wackerhagen, Hudson, N. Y.

The second prize in this class was awarded to John H. Chapman, Utica, N. Y.

The first prize in class second (harpoon forks) was awarded to C. C. Blodgett, Watertown, Jefferson co., N. Y.

The second prize in class No. 2 was awarded to S. E. & L. B. Sprout, Muncy, Penn.

These awards were subsequently confirmed by the Board of Managers, which has sole charge of the distribution of prizes by the Institute.

PRELIMINARY STATEMENT

FOR SUBSCRIPTION PAPER ON THE NEED OF AN INSTITUTE IN NEW YORK WHICH SHALL BE NATIONAL IN ITS AIMS AND INFLUENCE, AND THE MEANS REQUIRED TO PLACE THE AMERICAN INSTITUTE IN THAT POSITION.

It has been a common expression during the past three or four years, not only by members of the American Institute, but by its friends, that movements should be made to enlarge its action by the erection of a proper building of its *own*, on its *own* property, and otherwise extending its facilities for meeting the requirements of a great National Institute.

These expressions, it is well known, have also been accompanied by liberal proffers of money towards the carrying out of such ends. A number of gentlemen of means have offered on various occasions considerable sums each, yet there have been no steps taken to secure the benefit of such offerings.

In order that a practical beginning may be initiated toward the raising of money, and that when such offers are made there may be a record of them, several gentlemen, who have felt a zealous desire to see the American Institute go on and prosper, have drawn up the following form for your consideration, and hereby respectfully present it.

The American Institute of the City of New York was incorporated by the Legislature of the State of New York on the 2d day of May, 1829, for the purpose of encouraging and promoting domestic industry in this State and the United States, in agriculture, commerce, manufactures and the arts, and any improvements made therein, by bestowing rewards and other benefits on those who shall make any such improvements or excel in any of said branches, and by such other ways and means as to the said corporation or the trustees thereof shall appear most expedient. The estate and funds of the corporation, after paying all proper charges and expenses, were directed by the act of incorporation to be exclusively devoted to all the objects aforesaid, except so far as

it may be deemed necessary to apply its funds to the purchase and holding of any real estate and erecting any buildings thereon for the benefit and accommodation of the members of the said corporation and of those who may attend their fairs and exhibitions: which real estate they may sell and reinvest as they may find expedient.

The Institute commenced its operations without funds immediately after its incorporation, and has contined to the present time without any extraneous aid, never having received a single gift of money or real estate, or the smallest bequest, from the hundreds of wealthy citizens, dnring this interval. The only favor granted was from the city government, who allowed the Society at its beginning to occupy, for a short period, free of charge, vacant rooms in the brick building which formerly stood in the rear of the City Hall.

The first business was to inaugurate a system of annual Fairs, at which were exhibited specimens of the skill, industry and inventive genius of the United States.

In this the Institute was entirely successful, and each succeeding year its Fair was invested with increasing interest, until its annual opening was regarded as one of the great events of the city. The few thousand dollars of surplus accruing from these fairs was, by a commendable foresight, invested in real estate on Broadway, which has since so risen in value as not only to pay the current expenses of the Institute, but to provide for the excess of expenditures over the receipts at nearly all the fairs held during the last ten years, owing principally to the large outlay required to rent and fit up temporary premises of sufficient capacity wherein to hold said fairs, to meet the growing wants of these exhibitions.

Among the annual expenses of the Institute was the appropriation for the purchase of books. These have accumulated from year to year, until the library now contains over 10,000 volumes, including history, biography and travels, but principally treating on science and its applications to the arts. After the Legislature had authorized annual reports to be made and published, it was concluded that much valuable information might be disseminated by a free interchange of views and by statements of individual experience on the subject of agriculture at conversational meetmeetings. Accordingly, "The Farmers' Club" was organized and placed under the supervision of the committee on agriculture.

Subsequently the "Mechanics' Club" was organized, under the direction of the committee on manufactures, science and the arts. As chemistry and physics soon claimed attention, it was found expedient to give this club the more comprehensive name of a "Polytechnic Association." The weekly proceedings of these two branches of the Institute have steadily increased, until their reports constitute more than nine-tenths of the annual volume of Transactions.

A new period in the affairs of the American Institute has now arrived, which demands that it should keep pace with the spirit of improvement now actuating not merely our own, but every other enlightened nation. This spirit has prompted the expression from almost every member of our organization, that the United States now requires a National Institute second to none in the world, for the diffusion of information of a practical character relating to agriculture, horticulture and the industrial arts generally, supported and directed by practical men, with the aid of scientists of high attainments, and that the American Institute of the city of New York is legitimately entitled to such a position.

The first question for consideration is, what are the requirements of such an Institute? and the second, how can the American Institute be placed in a position to answer all such requirements? In reply to the first question, the general voice is that such an organization should not aim at the diffusion of knowledge of such an elementary character as to encroach on the province of the schools and colleges of the land, but rather to limit its influence to those of mature years, and to disseminate among them the results of experiments and experience relating to the arts, and the reports of new discoveries in science, as well as all new inventions tending to elevate the physical condition of man—in a word, to keep American citizens throughly informed of the latest improvements in all branches of technology. To accomplish this and give the greatest efficacy to mental effort, such an Institute must own and control a vast structure, suitable in dimensions and divisions to all its varied wants, situated in a central and appropriate locality, and of such architectural design as to be an ornament to the city and an attraction to strangers.

It should embrace a library, reading room, lecture rooms, a repository for models of works of art, rooms for the special use of its several standing committees on science and art, and lastly, but most important of all, for the annual exposition of working

machines and specimens of mechanical, chemical and agricultural products; halls of proportions commensurate with the probable future wants of a great, united, skillful and industrious population, which should constitute a perpetual exhibition of the achievements of modern science and art.

To the query how the American Institute can be placed in a position to answer all these requirements, the answer is now obvious: provide it with adequate means. It is already such an Institute, but of too limited proportions. In fact, its active intellectual powers have fairly outgrown the bounds of its material resources. Plainly, it needs that only which the capital of the country, distributed among all classes of people, can alone supply.

In order that all who contribute towards the purchase of real estate and the erection of proper buildings shall know that every dollar given will not be diverted to other uses, but be held sacred for the purposes intended, the Legislature of the State passed, April 21st, 1866, a law constituting a Board of Regents, which now consists of the following named gentlemen: Cornelius Vanderbilt, Edwin D. Morgan, Hamilton Fish, Denning Duer, S. F. B. Morse, Abiel A. Low, Gerrit Smith, Ezra Cornell, Orlando B. Potter, Henry Ward Beecher, H. W. Appleton, Henry W. Bellows, Elias How, Jr., and John W. Griswold, as permanent members; also, the trustees of the American Institute, the Mayor of the City of New York, the Governor of the State of New York, and the Secretary of the Interior of the United States, as members *ex officio*, the whole forming a board of 24 members, whose powers and duties are defined in the following sections of the law:

"§ 3. All donations, bequests and devises hereafter made or given to the American Institute shall be taken and held by the said Board of Regents in trust for the said Institute."

"§ 4. The said Board of Regents shall have power to purchase, or receive, by gift, grant or devise, real or personal estate to the amount of one million of dollars, and to sell or dispose of the same as they may think proper, in the erection of buildings, the construction of laboratories, machinery and museums of art, for use of said Institute; and they may appropriate a portion of the annual income to establish and maintain professorships and lectures in the said city of New York, on natural history, physics and chemistry, and their application to the useful arts; and also to print and circulate throughout the United States, documents

relating to agriculture, manufactures and commerce, and to use any other means to make the said Institute national in its influence and character."

§ "5. The said Board of Regents shall have no control over the property now belonging to the Institute, and shall not interfere with its operations as at present conducted, except so far as power may be delegated to them by the regular action of the said corporation."

It has been an ordinary occurrence for members of the American Institute, and those not members, to offer large sums of money to carry out the objects above set forth, and in order that there may be a practical commencement to that end, the following form of an agreement has been drawn up for the signatures of those who are willing to become benefactors and patrons of the American Institute :

We, the undersigned, severally agree to pay to the Board of Regents of the American Institute of the City of New York, for the purposes set forth in the preceding article, the sum of money set opposite our respective names, when subscriptions to the amount of $250,000 shall have been made for that object.

LETTER

CONCERNING M. ANDRE LEROY, OF ANGERS, FRANCE.

The Hon. HORACE GREELEY,

President of the American Institute, City of New York:

SIR—Charged with the agreeable duty of delivering to M. André Leroy of Angers, France, the Large Gold Medal and Diploma of the Institute, awarded to him for the fine collection of fruits, sent to its Exhibition held in New York in September, 1864, I have the honor to report :

That the Diploma and Gold Medal were delivered to him in December, 1865, the receipt of which and his letter of thanks is on file in the office of the Institute.

Mr. Leroy also instructed me to make known personally to the members his high appreciation of the honor thus conferred, and of his desire in the future to render all the aid in his power for the advancement of the views of the Institution.

A brief description of this renowned nursery of M. André Leroy may not be uninteresting to the members, as it occupied me nearly two days to compass it and its management.

In a large work published in Paris in 1863, called "Les Grandes Usines de France," or the great workshops of France, the Nursery of M. Leroy is given a conspicuous notice, as one of the great workshops of France, and it truly is a "manufactory of trees," etc.

Angers is situated in about Lat. 47 deg. N. and Long. 1 deg. W. from Greenwich, in the N. W. of France, near the River Loire, and reached by rail in about eight hours from Paris. Being about eighty miles from the Bay of Biscay, the effects of the Gulf Stream which impinges on the west coast of France, so modifies and tempers the atmosphere, that severe frosts are unknown, and the almost constant canopy of clouds in the fall and winter months preventing the radiation of heat, the result is a climate resembling that of Florida, giving a wonderful facility in propagation of stock.

The Nursery of M. André Leroy opens into a circular place in the town of Angers, called "Magnolia Place," which is planted around its circle with fine specimees of our "Magnolia Grandiflora." This establishes the exceptional climate of this district, for here, in a latitude nearly two degrees north of Montreal, this tree flourishes with luxuriance, as well as the Olive Pistache, Camellia, while with us the M. Grandiflora does not thrive further north than Richmond, Va., say about 38 deg. N. or 10 deg. below Angers.

In the town portion of the nursery are avenues of these Magnolias, and in the outer grounds are acres of these glorious trees, one large planting called the "South Carolina Forest," containing 40,000 in various stages of growth. The green tea plant also grows here in perfection, and I had the satisfaction of seeing the plants with blossoms and berries, and of drinking the tea, from the dried leaves of the previous season's growth.

There are some peculiarities in the management of this nursery; one for instance, that no plant is cultivated which requires protection of glass, which of course saves immensely in working expenses, and enables them to plant what is grown, on a very extensive scale. It was to me a novelty to see cuttings of Camelias by the tens of thousands planted in the open ground, where they root freely and make fine plants without any care, save, perhaps a raised mat in very severe, or very sunny weather, and a few inches of sand about the roots. Here are to be seen Camelias in all stages of growth in the open ground, one I measured was 18 feet high and 18 inches trunk in diameter, and some also 25 feet high, covered with flowers. No wonder that all in France, poor or rich, can enjoy and do have an abundance of flowers, when they are grown at such small expense.

The growth of evergreens is on an extensive scale also, and here the ease with which plants were manufactured is surprising; not to mention others, I observed such a large quantity of the "Sequoia Gigantea," which I learned were grown as follows: Seed planted in open ground in March, plants transplanted in July, and in January the plants and roots measured over two feet in length. There are specimens 20 feet high in these grounds of this monarch of all trees.

Mr. Leroy has several hundred acres engaged in producing in this rapid manner, and is acquiring when he can, further ground for his increasing business, and among his recent acquisitions, he

has secured with a certain tract purchased, an ancient chateau, which he is now restoring, and which was in its day, of doubtless great renown, as it has embroidered in its stone tablets, royal quarterings and also the evidence of its having sheltered the Knights Templars, as the chapel is in good preservation and the "scollop shell" of the Crusaders, sculptured on its stone walls testify its former uses and origin. Another interesting feature connected with this nursery is the "Hospital" for the worn out workmen, who have become incapable of further work. I saw these old men, who had been in the employ of Mr. Leroy's father, sunning themselves and well taken care of, and could not but appreciate the propriety of such benevolence.

His collection of pears and apples is very complete, and comprises we presume every known variety save perhaps some new seedlings of American origin. His catalogue of 1866, embraces, including synonymes, nearly 1,000 varieties of pears, and over 500 of apples, and in his great work on Fruits, now publishing, he informed me that the drawings and descriptions are all from trees in bearing and from the actual fruit.

It would be of little service to do more than mention the fact, that there are acres of roses, rhododendrons, forest and other trees, surubs and small fruits, including all the known varieties of grapes cultivated in Europe; the greatest demand is, however, for the "Chasselas of Fontainbleau," for private planting and table purposes—a small white grape, which keeps well. I found a corner of his vineyard occupied by a few unthrifty vines from America, among which were Isabella, Catawba, Lenoir, Charter Oak, &c. No wonder they think our native grapes unfit for cultivation, with such varieties, and placed against a north wall, where the sun could not reach roots or vines.

I cannot close these brief remarks without referring to the great work M. Leroy is engaged in, viz: his "Dictionary of Pomology," in 5 vols., 8⁰. Two volumes will alone be occupied with pears. Accompanying this will be found advance sheets showing the completeness of the work, than which nothing can be more thorough and exhaustive. It has occupied years of labor, and the cost of the first impression has been near 50,000 francs. As this will doubtless be the standard work for foreign varieties, I recommend him to also have it issued in the English language, and it is perhaps likely to be done. Let me briefly indicate its style, as follows:

1st. Every fruit drawn, and the descriptions written are from actual specimens on the trees, and compared the second year.

2d. Profile sections of fruit, and where the shape varies, the second type or form is given.

3d. Description of tree, which covers wood, branches, eyes and leaves.

4th. Fertility, whether prolific or otherwise.

5th. Culture, whether for dwarfs or standards.

6th. Description of fruit, viz: size, form, stem, skin, color, flesh, flavor.

7th. Maturity, whether early or late.

8th. Rank, whether first or other quality.

9th. History of origin, &c.

10th. Observations.

11th. Synonymes.

Until we fairly try in this country all the varieties thus described, it would be unjust to its author and ourselves to say that it will be of little value to us under our different climatic influences; our present enjoyment in the possession of so many fine foreign varieties is sufficient to show that we cannot ignore them, unless to our own detriment.

I am aware of the fact, that there is a question in the minds of planters, as to whether stock grown in localities not subject to severe atmospheric changes, can thrive or withstand the change to localities subject to great frosts, and the question has not had sufficient attention; for if there is risk of this nature it should be known and avoided; and, coming within the the duties of the Institute to decide such points, I therefore respectfully propose that this subject be thoroughly discussed by the Horticultural Society and the Farmers' Club of the Institute. The question comes up naturally in describing this renowned nursery, which exports largely to this country and to all parts of the world. My own belief is, that the vigor and growth gained in the first or second year, under such mild and favorable climatic influences, is, in regard to *really hardy* varieties, of great value and benefit in their aftergrowth, under less favorable circumstances.

M. Desportes, the kind and attentive associate of M. Leroy, who has been in this country and is known to most of the fruit growers of America, in connection with M. Leroy, extends a cordial invitation to any and all the members of the Institute to visit them; and those who do extend their journey to Angers, will

experience a hospitality which they will remember with pleasure.

These gentlemen furthermore requested me to say, that at any time the Institute holds a fruit exhibition, if notified, they will be most happy to contribute.

Most respectfully yours,

BENJ. C. TOWNSEND.

NEW YORK, *May*, 1866.

PROCEEDINGS OF THE FARMERS' CLUB.

Rules and Regulations of the Farmers' Club of the American Institute, adopted by the Committee of Agriculture.

1. Any person may become a member of this Club, and take part in the debate by simply conforming to its rules.

2. Any member, for disorderly conduct, may be expelled by a vote of the majority.

3. The minutes of the Club, notices of meetings, etc., shall, as formerly, be under the control of the Secretary.

4. The Club shall be called together Tuesday, at 1½ o'clock, P. M., of each week.

5. A chairman pro tem. shall be chosen at each meeting.

6. The first hour of the meeting may be devoted to miscellaneous subjects, as follows : papers or communications by the Secretary, communications in writing, reports from special committees, subjects for subsequent debate proposed, desultory or incidental subjects considered.

7. The principal subject of debate shall be taken up at 2½ o'clock (but may be introduced earlier by a vote of the meeting) and continue until 3½ o'clock, unless a motion to adjourn prevail.

8. No person shall speak more than fifteen minutes on the principal subject, unless by consent of the meeting.

9. All controversy or personalities must be avoided, and the subject before the meeting be strictly adhered to.

10. Questions pertinent to the subject of debate, may be asked of each through the chairman, but answers must be brief, and not lead to debate.

11. The chairman may, at any time, call a person to order, and require him to discontinue his remarks.

12. When any committee is appointed by the Farmers' Club, the members of said committee shall be members of the American Institute.

13. No discussion shall be allowed that is not connected with the great subjects of Agriculture and Rural Improvement.

April 17, 1866.

The regular session of the Club was held on Tuesday afternoon. At half-past 1 o'clock, NATHAN C. ELY, Esq., the permanent Chairman, called the meeting to order; Mr. JOHN W. CHAMBERS filling the post of permanent Secretary.

Mr. Solon Robinson presented, with valuable comments, the following alphabetical list of

FRUITS IN THE SEASON.

Apples—Our first receipts, before the Rebellion, were from the interior of South Carolina, shipped from Charleston about the middle of May. Following these were Virginia apples from June 5 to 10, and the latter part of the month, South Jersey fruit made its appearance, but not until the middle of July are good apples plenty. They are in good supply from the middle of August until April, in ordinary seasons, with a few extending into June. Those of Northern growth keep best.

Apricots—These were formerly plenty, but since the days of the curculio their cultivation has nearly been abandoned, especially as a market crop. In former times they made their appearance from Charleston the 1st of June, and by the 10th we had arrivals from Norfolk, and occasionally a few from Delaware and South Jersey in July, but at no time are they plenty, and comparatively few persons even know what they are. A few apricots are grown along the Hudson river.

Bananas—A foreign tropical fruit, largely brought from the West Indies, beginning the latter part of March and extending up to the middle of July. The greatest supply is during May and June.

Blackberries—These have formerly been brought to market only from the vicinity of the city—largely from Long Island and New Jersey, during the last of July and August. Attempts are being made to introduce them from South Delaware and the eastern shore of Maryland, where they ripen the latter part of June. This will extend the blackberry season over more than two months. The wild sorts, in this vicinity, are rapidly giving way to the improved cultivated Lawton, a most profuse bearer. The Dorchester and Kittatinny are beginning to attract attention.

Cherries—The first cherries are from Virginia, reaching here from Norfolk the middle of May. A little later we have Baltimore fruit, and by the middle of June they begin to arrive from Philadelphia, closely followed by New Jersey cherries. The

markets are best supplied from the 20th of June till the 1st of July, though the Morello or sour cherries continue well through July. Most of the late fruit comes from the vicinity of Rochester.

Cranberries from New Jersey, make their first appearance the middle of September, followed by Cape Cod berries the 1st of October, about which time western fruit begins to arrive. Keeping a long time, they remain in market until the 1st of April, when rhubarb takes their place, though cranberries are occasionally on sale up to May 1.

Currants—Are a northern fruit, not flourishing well at the south. Green fruit, from New Jersey, is on sale the last of May, and ripe fruit from the middle to the last of June. They extend over a long period, usually through August, the bulk being in market the last half of July. Black currants are only good when ripe, and not then in much demand, though some persons are very fond of them. Season, last of July and first of August.

Gooseberries.—Arrangements are being made to receive gooseberries from Maryland. They can be shipped from there in a green state, by the 10th of May. Jersey berries begin to appear about the 20th of the month, and are the first fruit to follow rhubarb. They continue well through July. The majority of those sent to market are the small native sorts.

Grapes—Hot house grapes, though furnished to the Broadway and other saloons much earlier, are not often in market before the middle of June, and are not plenty before July and August—in fact they are never plenty. Imported grapes are found on sale, in limited quantites during the autumn and winter months. The first out-door native grapes now come from New Jersey, September 1; we expect to soon see them from further south much earlier. By the middle of September they are in fair supply, and in their greatest abundance the last of the month and early in October, though the market is well supplied up to December and even through the holidays. Perhaps no fruit is gaining faster in the appreciation of the masses than the grape. Improved varieties are fast taking the places of the old Isabella and Catawba, and all appearances indicate that ours is to be a *great* grape country. Late inventions and experiments with preserving houses, give assurances that we are to have fresh grapes in the spring. Our latest and best keepers, at present, are Catawbas sent from Ohio.

Lemons—These are mainly from Sicily, and are in market sparingly, from February until August, their greatest abundance

being in May and June. Malaga lemons are received from October until March.

Melons—We include these among the fruits. Water melons come in sparingly from the West Indies, the last of May and early in June, followed by Virginia melons, the middle of July, and from Maryland the 1st of August. New Jersey melons begin about the middle of August, and they remain on sale through September. Nutmeg or citron melons arrive from Virginia about the 20th of July, and from eastern Maryland soon after. New Jersey and Delaware furnish the majority of this fruit, from about the middle of August until the 10th of September—often much later.

Nectarines are so little seen in market, that few know them, and even then take them for peaches. The first receipts were formerly from South Carolina about the 10th of July. A few arrive from Virginia from the middle to the 20th of the month, and the light supply of Delaware and Jersey fruit is in the market the last of August and early in September. A few are grown along the Hudson River.

Oranges—Havana fruit begins to arrive about New Years and continues until the middle of April. Sicily oranges are in market from January to August—sometimes later. A few oranges are raised in South Carolina, Georgia and Florida, but seldom find their way here.

Peaches are never too early, or continue too late, and though very abundant some seasons, people rarely tire of them. They are emphatically *the* fruit, and during their season little else in the way of fruit is desired. In the "olden time"—all the *good things* of which, are about to be realized again—our first peaches were from South Carolina, received here about the 20th of June. Virginia fruit began to arrive the 12th of July, Delaware peaches August 1, and New Jersey fruit the middle of the month. The markets are usually supplied up to the 1st of October, and even later. The greatest abundance is from August 20 until about the 10th of September.

Pears from South Carolina and Georgia began to arrive in former years July 15; from Virginia the last of the month, and soon after from Delaware and New Jersey. If the *early* fruit were sent from the south, it might reach here in June even, but pears do not sell well until the glut of peaches is over. They are in the greatest abundance in September, and continue until February, though scarce after the middle of November.

Pineapples.—These are from the West Indies, and though a few come in at irregular periods, the majority of the fruit is received from the 1st of May until the 1st of September, their greatest abundance usually being in July.

Plums can only be raised successfully in certain localities, the curculio being their greatest enemy. They formerly began to arrive from South Carolina June 20, and from Virginia early in July. Very few plums are raised in Delaware and New Jersey; but along the Hudson river they flourish well, and are usually on sale abundantly during September, and extend into October.

Quinces are a late ripening fruit, not good before maturity. They are on sale during October and the first half of November—sometimes later. We seldom receive them from south of New Jersey.

Raspberries follow strawberries, and are seldom received beyond New Jersey, as they are difficult to transport. The market begins to be supplied the 1st of July, sometimes in June, and they are nearly over in three weeks. The bulk of the fruit comes from along the Hudson river, where the Antwerp berry is chiefly cultivated. Wild and also cultivated berries come in quite freely from New Jersey.

Rhubarb, though not fruit, bears so much resemblance to it in its uses, that we include it here. It is the earliest *fruit* in market, and is welcomed as a change from dried fruits. The consumption, mainly for pies and dumplings, is immense. The little grown in cellars, hot-beds and forcing houses is seldom thrown into market, the earliest appearance for general sale being about the first of April, and though a little is offered all through the summer up to September, it is not plenty or much called for after the 1st of June. It is only raised for this market in New Jersey, on Long Island, and the near-by portions of the State.

Strawberries.—Next to peaches, these are the people's fruit, on which all classes feast for at least a month. Being rather tender of transportation, we do not get them south of Virginia. The first chest sent from there the present season was from the noted grower, Mr. W. I. Bishop, of Portsmouth, received here May 6. About the middle of the month Baltimore berries begin to arrive, followed by those from Philadelphia about the 20th, and South Jersey fruit is on sale at the same time, but the market is scantily supplied until about the 10th of the month, from which time up to the 25th they are usually abundant, and often continue up to

the 4th of July. A few forced berries are seen in the saloons in April.

Tomatoes.—The first tomatoes are from Bermuda, received this season March 15, but come in sparingly from there until about the 1st of June, and even then are not plenty. Virginia tomatoes begin to be received the 10th of July, and from New Jersey we get this fruit the latter part of the month. Long Island is a great tomato region, filling the markets from August 1st until October, and frequently through that month. Large quantities are also raised in New Jersey, and the increasing demand yearly calls for an additional number of acres of this fruit, so extensively used raw, stewed and for making catsup, to say nothing of the large amount put up for winter use in air-tight cans and bottles.

Whortleberries are first received from New Jersey early in July, and following these are the Long Island and up river berries, which extend the season through August and September.

Cultivation of Flowers.

Mr. Solon Robinson—The following short descriptions of various sorts of hardy flowering plants, and time of planting seed, and time of flowering in situations similar to the central part of the State of New York, will greatly assist those who are not already skilled in floriculture.

I will here remark, that because a plant or flower being new, and sold at a high price, is not always a proof that it is superior to old, long proved sorts. The very fact that a certain flower has been cultivated from generation to generation, is evidence of the esteem in which it has been held, and we still cling to many of those old sorts, though disposed to give the new a fair trial, as they are brought into notice. And here, too, is a reason for caution against planting too many varieties, unless one has ample space and time to care for them. A few kinds, on properly prepared ground, and well cared for, will give much better satisfaction than a great variety hastily put in, and left very much to themselves after being sown.

The flowering shrubs, which once set out are good for many years, should not, of course, be neglected ; in fact they are absolutely indispensable to make up the flowering season. Those with ample grounds and time to care for them, will, of course, extend the list.

But before selecting, a few words about sowing seeds in general. Nature scatters flower and other seeds upon the ground by frosts

which burst the burs or capsules, or by rains and winds blowing and washing them out. The tramping of feet, washing of rains or falling of foliage, gives them a slight covering where many of them vegetate. The gardener assists nature in this particular by covering all the seeds, but is also instructed by her as to the kind and depth of covering. As well might small seeds which push out a tiny shoot, in search of light and air, be scattered to the winds as buried six inches beneath the soil. With few exceptions, the smaller the seeds, the nearer the surface should they be deposited, from one-half inch to an inch in depth; if the season is wet, one-fourth to one-half inch is deep enough for the smaller seeds. The ground should be rich, well drained, and finely plowed or dug at least one foot in depth.

Annuals, or flowers which, sown in Spring, bloom and perfect seeds the same season, dying out in the Fall.

Ageratum Mexicanum is a good massing, or border plant, one foot high, hardy, blue flowers, though small, but in bloom until frost. Sow about the middle of May, in a finely prepared border.

Sweet Alyssum is also a constant bloomer, six to twelve inches high, quite fragrant, white, and good for edging. This is a hardy plant; some varieties are perennial.

Asters should be included in the smallest collection. The newer French and German sorts of double, quilled, peony and chrysanthemum flowered asters are such improvements on the old single "China oysters" of our grandmothers as to bear no comparison with them. They are of all heights, from the dwarf of six to eight inches, to Truffaut's Perfection of two feet, and of almost every shade of color; sometimes distinct, at others blended and intermixed in the same flower. They are autumn flowering, of easy culture, and very attractive. Sow early in May.

Balsams are also very pretty, especially the double rose flowered. Require good soil and culture to attain perfection, and then flower during most of the season, bear careful transplanting well. They sport a variety of colors, and grow from six inches to two feet high. The double sorts are liable to show single flowers on poor soil.

Calliopsis, or *Coreopsis*.—The several varieties of dwarf and tall growing sorts are quite pretty, the dwarf 8 to 10 inches high, the others 1½ to 2 feet. They are of the various shades, from bright yellow to orange and brown, and are well adapted to massing or planting thickly in separate beds, early in May.

Candytuft is none the less desirable for being old. The purple variety, especially, makes a fine border plant, while the sweet-scented is quite fragrant. Should be sown very early in spring.

Cockscomb (*celosia cristata*) is desirable, some of the improved sorts being elegant masses of crimson flowers. The dwarf sorts grow one foot, and the tall varieties two to three feet high. Sow early in a warm, rich soil. The crimson and scarlet sorts are prettier than the yellow varieties. They make fine pot plants for house culture, but are perfectly hardy in the open air.

Convolvulus, *major* (Morning Glory), and *minor*, a dwarfish plant of the same species, is too pretty to be omitted. For covering screens, old buildings, fences and rock work, they are nearly unsurpased; and though the flowers are closed during mid-day in hot weather, the rich, gorgeous show in early morning repays well for all the trouble. They are most hardy, and succeed everywhere. One variety, the *Cantabricus*, is a fine plant for hanging baskets. Sow early in May.

Dianthus—Chinesis—(Chinese Pink) should not be omitted. Though not strictly annuals, they flower the first season, endure the winter unprotected, and give a still finer bloom the following year. The double flowers are pure white, white striped with red and purple. The *Heddewigii*, especially, is a splendid, showy flower, continuing a long time in bloom. The *laciniatus* variety has deeply serrated petals, grows two feet high, and is a free and continuous bloomer.

Delphinium ejacis, *consolida* and *ealtior*—(Annual Larkspur)' make fine border or massing plants, some of them very pretty. They are of various colors, and grow from one to two feet high Sow from April to June for succession.

Double Daisy.—So universally admired, though not an annual, usually flowers the first season, and by a little protection the roots will live through the winter. They are fine border plants along a walk, or as edging for flower beds—do best in a partial shade.

Eschscholtzia Californica and *crocea* are brilliant, yellow-flowering plants, almost dazzling the eye in bright sunlight. They do not bear transplanting well, and should be sown where they are to stand. A dwarf variety (*tenuifolia*) has small, pale yellow flowers, borne six inches high. There is also a white variety. Sow in April and May.

The *Gaillardia* family, though not as hardy as some other

plants, make a fine show of bloom until killed by frost. The *picta*, *Josephus* and *grandiflora* are especially desirable, growing eighteen inches high. Give them plenty of room.

Ipomœa quamoclit—(cypress vine) is a universal favorite, both on account of its fine, feathery foliage, and its brilliant little trumpet-shaped flowers. They require warm situations, and make the finest show when sown in a circle two or three feet from a central stake eight to ten feet high, to the top of which they are trained by means of strings fastened to the ground by pegs. The scarlet or crimson sort makes the finest show. It is well to soak the seeds in warm water for a few hours before planting, and only put them in the ground when it is warm and dry—about the middle of May, if the ground has become warm. They do best started in a hot-bed and transplanted. Some of the other ipomœs—as *limbata elegantissima* (blue with a white belt), *grandiflora Mexicana* (large violet blue), etc., are desirable climbers.

Loasa nitida—(Chilian nettle plant), is a fine plant for growing along a street fence, or a border where flowers are picked by passers by. In plucking the prostrate yellow blossom, the hand comes in contact with the branches covered with stinging hairs, nearly as poisonous as the sting of a bee. It is a tender annual, and should be sown late in May.

Lychnis.—The common scarlet, and some of the newer varieties, as *Haageana* and *Sieboldii*, are desirable flowers, growing from one to two feet high, and though perennial, will usually flower the first season, if started in the house early, so as to transplant in May.

Marigold (*Tagetes*) is one of the oldest flowers, and not altogether a favorite, owing to its rank odor. Some of the newer French sorts are quite pretty, and all of the varieties bloom the entire season. A late sort, Tagetes *signata pumila*, forms a dense mass of foliage and flowers, in a globular form, 18 inches in diameter, on one plant of which a thousand flowers are sometimes grown. Sow in May.

Mignonette (*Reseda odorata*) will, of course, have a place in every garden—at least if ladies have aught to do with it. Does best in masses, and the inconspicuous flowers give off a delightful fragrance during the entire season. It is hardy, may be sown early in May, thinned out that each plant may have room.

Marvel of Peru, or Four o'clock, (*Mirabilis Jalapa*), makes a fine show from the time it begins to bloom until frost. Some of

the variegated sorts, as red or lilac striped with white, yellow and red, etc., are quite pretty. They grow 2 to 2½ feet high, quite branching, hence should be thinned 2 feet apart. It is a perennial, and the roots may be preserved over winter in sand.

Nemophila, insignis, maculata, discoidalis, etc., do finely when planted in a cool, partially shaded situation. The flowers burn in a hot sun, but in a shade they are very pretty—blue, spotted and variegated flowers. Height 6 to 12 inches; to be sown carefully in fine soil about the middle of May.

Evening Primrose (*Œnothera Lamarckiana, Drummondii, Veitchii, acanlis alba*, etc.,) though not perfectly hardy, are so pretty they should be grown by every one having a large collection. They are generally perennials, but the above bloom the first season, opening their flowers toward evening and remaining in bloom for a while in the morning. The *Lamarckina grandiflora* grows 3 feet high, bears its large yellow flowers—4 inches in diameter—in clusters, and continues in bloom until frost.

Sweet or Flowering Peas, of various colors mixed, are both pretty and fragrant. They are fine for screens, or to grow in clumps, and when kept from going to seed will flower all summer. The several varieties attain a height of 2 to 6 feet, and require brush or other support. For succession, sow from middle of April to June.

Petunias—May be easily grown from seed, though plants are usually obtained from florists. They flower the first season, and if seed of fine varieties is sown, most of the plants will be desirable, perhaps something very choice. The newer double, blotched and large flowering sorts are splendid flowers, and to secure any established sorts recourse must be had to cuttings or layers. Sown early in May, they begin to bloom in June, and continue in flower until killed by frost.

Phlox Drummondii is entitled to a place in every flower garden; the delicate masses of bright-hued flowers form an attractive show all summer. There is a variety of colors, from pure white to rose, pink, scarlet, crimson and variegated; of dwarf habit, they are fine for edgings, or for forming distinct beds.

Portulaca—The various brilliant colors of this trailing plant have always been admired, and now with the perfectly double sorts of distinct colors, also striped, we have a still more desirable plant, thriving in the scorching sun and dazzling the eye with vivid color. Sow as early as last of April or first of May.

Picinus, or Castor Oil Plant.—This is grown for peculiarly formed and ornamental foliage, and erect, stately habit, rather than its bloom, which is insignificant. It also has the reputed credit of keeping moles from the grounds where grown. Does best as single specimens, and is fine for growing with shrubbery in the lawn, attaining a height of 3 to 15 feet.

Ten-Week Stock (*Mathiola annua*)—Should by no means be neglected. Its numerous spikes of fragrant double flowers, almost equaling the hyacinth in richness, retain their luxuriant appearance from July until frost. They are of nearly every shade of color, and are every way desirable, growing 6 inches to 2 feet high. Sow in May, in rich, finely prepared border.

Nasturtion (*Tropæolum major* and *minor*).—These are fine plants to grow along fences, old stone walls, etc., their dense foliage and semi-climbing habit soon covering unsightly objects. The foliage is quite ornamental, and flowers of brilliant orange, red and variegated colors. Beside being ornamental in flower and foliage, the green seed capsules form a desirable pickle. One variety, the *peregrinum* (Canary flower), is a good climber, growing 10 to 15 feet, and blooms like all other species until frost. Sow in May.

Zinnia.—The old sort was pretty, but is now mostly superseded by the double variety, a splendid showy flower when planted in masses. It is an annual, and not only blooms continually until frost, but the flowers, by their own successive changes of color, give to the whole mass an ever varying beauty. Some of the double flowers are very large, but seed of these will sometimes produce single flowers, especially on poor soil. They grow 1½ to 2 feet high. Sow in a nicely prepared border, in the first or second week of May.

Among the *Everlasting Flowers*, Acroclinium *roseum*, Gomphrena *globosa* (globe amaranth), Helichrysum, Rhodanthe *maculata*, and Xeranthemum are most desirable. They are to be sown about the middle of May, in finely prepared soil.

Perennial Flowers—Or those which do not bloom the season they are sown, but endure the winter and flower the following and succeeding years. In this respect they are less trouble than those which require sowing every year, and as a class perhaps more beautiful. One other thing is in their favor, viz.: they may be sown late in spring after the hurried season is over, and they will flower just as well the following year. Many persons who think it too much trouble to sow annuals every spring, prefer these

perennials on account of the little care they require when once established, as nearly all of them may be increased by dividing the roots or layering the branches. In these we do not include the dahlia, lily, tuberose, gladiolus, pæony, dicentra, &c., to be set in the spring, nor hyacinths, tulips, crocuses, &c., which should be planted in the fall, roots or bulbs of which should be obtained of a florist to give one a start. Besides these there are some "bedding plants," which those who do not have a hot-house or conservatory can best procure from persons who have, so as to set out plants either in bloom, or what is better, those that will soon flower.

We name the following as worthy of cultivating:

Snapdragon (*Antirrhinum majus*)—Brilliant scarlet, orange, crimson, striped and white flowers, blooming the first season and continuing in flower even after hard frosts. They are perfectly hardy, and when established, the roots may be divided to increase the stock. They grow from six to eighteen inches high.

Canterbury bell (*Campanula medium*) is a most showy and beautiful perennial, growing on a spike one to two feet high. Flowers blue and white, some of them double. The *pyramidalis* is a large sort, three feet high.

Chrysanthemum.—Very desirable for a late bloom, and pretty withal. It will blossom after hard frosts, sometimes after a snow fall. There are two varieties—one tall, two feet or more in height; the other dwarf, scarcely one foot high, both of various colors, and some of them of them quite double. The *venustum* is a good dwarf sort.

Columbine (*Aquilegia*) is a showy flower, opening quite early in spring; colors white with red stripes, scarlet and yellow, some of the flowers being quite double. They grow from one to two feet high, and flower in succession for a long time.

Carnation and Picotee (*Dianthus caryophyllus*) rank among the prettiest flowers of the garden, beside being fragrant and continuing a long time in bloom. They may be sown in a warm border in the middle of May, but form stronger plants when sown earlier, in a house or hot-bed. Desirable established sorts are propagated by cuttings and layers. It is well to give the plants a covering of coarse manure in the fall, as old roots are not perfectly hardy. Indeed, it is unsafe to leave them without protection north of New York city.

Foxglove (*Digitalis purpurea, lanata, gloxinæflora, etc.*, form

beautiful spikes of showy flowers, purple, white, yellow, spotted, red, &c. They are more strictly biennials, but often bloom for two or three years. Sow middle of May, and take off new shoots to perpetuate sorts.

Holyhock (*Althea rosea*).—One of the oldest flowers, but has undergone modern improvements. This too, is classed among biennials, but by taking off the new offsets, or propagating by slips, desirable kinds are perpetuated. Some of the dwarf double sorts are very desirable, growing about four feet high, while the tall sorts reach six and eight feet. They continue in flower a long time, from the first opening of the lower bud until the final bursting of the topmost one. Sow at any time in May, or even in June and July, and they will flower the following season.

Penstemon Wrightii (scarlet), *Murrayanum* (vermillion), and *Jeffreyanum* (light blue), are handsome perennials bearing their bell-shaped flowers in graceful spikes. They grow from one to two feet high, and flower from June or July until October. There are several other species not mentioned above, all pretty, and most of them hardy. Do best sown in a hot-bed, but may be sown in a warm open border, the middle or last of May.

Perennial Phlox.—If only three perennial flowers are grown in a yard, one of them should be a root of phlox. A bed of the different colors—always obtained from seed—will form a magnificent show all summer long. The prevailing colors are purple, red and white, often delicately blended in the same flower; one variety of dwarf habit, called "moss pink," forms a perfect mat of bloom the last of April or early in May, and is often employed for edging. Others, such as *maculata* (Flora's bouquet), with purplish red flowers, *Van Houtteii*, striped, grow one a half to two feet high, and flower in June and July, while the tall growing fall sorts such as *Mary Ann*, purple centre and white margin, *Wilderii*, deep red, and many others, grow two to three feet high, and flower from July until September, so that with this flower alone an endless variety of bloom may be kept up through the season.

Garden Pink (*Dianthus hortensis*) is closely allied to carnation, but more hardy. It is easily grown, perfectly hardy, very fragrant, about one foot high, blooming the last of June. Sow on a dry soil middle of May.

Garden Rocket (*Hesperis matronalis*).—The sweet, purple sort is one of the best; very fragrant, flowering in long spikes in May and June. It is perfectly hardy, easily grown, and is a good

flower for bouquets. Grows one and a half feet high. Sow from the middle of May until the middle of June.

Sweet William (*Dianthus barbatus*) very properly finds a place in all collections. The *name* itself is endearing to many a fair cultivator of flowers. Of most easy culture, very fragrant, and of a variety of attractive colors, forming a perfect truss of bloom, it is a universal favorite. The late *Auricular flowered*, and some other sorts, are very pretty. Sow at any time in spring or early summer, and they will bloom the next season.

Flowering Shrubs.

Early spring is the best time to set most of these plants, and there is nothing difficult either in the planting or after management of those here introduced. They are hardy, too, unless otherwise noted, and will flourish on any good garden soil. In setting them, unless the ground has been thoroughly and deeply dug, which is always better, make the holes of good size, sufficient to receive all the roots without cramping, and give them some chance to extend in the freshly filled-in soil. The hole should be deep for the same reason, unless in clayey soil, while a basin will be made to hold water. Such land should be underdrained. If the roots have been mutilated in taking up, pare the wounds smoothly, cutting to firm wood with a sharp knife. Fine roots will push out from such a cut, or it will heal over much sooner than a rough, torn end. The ground may be made rich with well decomposed manure, but it is unsafe to put clear manure in the hole about the roots. Old turf, inverted in the bottom of the hole, makes a fine bed on which to spread out the roots. They will readily penetrate these turfs and derive much nourishment from them. Trample the sods down a little, and sift over some fine earth to fill all cracks. Sift in fine surface soil about the roots; if a little old muck, peat or woods earth is added, all the better. Use the fingers about the fine roots, and see that no cavity is left under the roots beneath the stem. The soil should be pressed close about every part of each root. Now for the selection, including a few which do not bloom, but are prized for their foliage.

Amygdalus pumila (double dwarf-flowering almond).—A pretty low-growing shrub, bearing a profusion of double rose-like flowers covering the shoots before the leaves start in the spring. Of most easy culture and every way desirable. Blooming in May.

Buxus arborescens (tree box) and *suffruticosa* (dwarf box) are

both desirable broad-leaved evergreens. The former grows to a height of four and even six feet, and is sometimes pruned or sheared into fanciful shapes. The latter is a fine edging or border plant in common use. Neither of them flower, and, to some persons the odor is objectionable.

Calycanthus lavigavas Floridus, etc. (sweet-scented shrub), are prized for the highly-scented inconspicuous flowers, which are often gathered and put into clothes-drawers to impart their perfume. The *Floridus* is sometimes called Carolina allspice. They are very free-growing, branching plants, three to four feet high, flowering from June to August. There is a native variety in nearly all of our forests.

Chionathus Virginica (White Fringe) is almost a tree, growing 15 to 20 feet high, but flowers when it has attained the height of six or eight feet. The foliage is rather ornamental, but the graceful flower stem of six to twelve inches in length, loaded with its white flowers, gives it a fringed and attractive appearance. It is not as easily grown as most other shrubs, and is often grafted upon small white ash trees.

Cratœgus or Flowering Thorn.—There are several species of this early and profuse flowering shrub, and one variety, the *C. pyracantha*, retains its foliage during the winter. Most of the flowers are white, appearing in clusters in May, but the *C. oxyacantha*, or Hawthorn, has single red, double red, and double white flowers. This and some other species attain the size of small trees when growing alone, and are much used for hedges, especially in England.

Cydonia Japonica, often called *Pyrus Japonica* (Japan Quince) shows its bright clusters of scarlet flowers in April, before the leaves have attained much size. When in full flower it is one blaze of bloom, which none can fail to admire, and being extremely hardy, and readily grown from layers or suckers, it is a very desirable shrub, usually growing three to four feet high, though it is sometimes seen six or eight feet high. It is of rather slow growth, spreading in habit, and begins to flower quite young.

Daphne mezerium (Pink Mezereon) is one of the earliest flowering shrubs, the bloom appearing in April before the leaves, and on this account should be transplanted very early in spring, or in the fall. The clusters of fragrant pink flowers are followed by scarlet berries. Grows from four to six feet high.

Deutzia, scabra, crenata, gracilis, etc., are very desirable free-

blooming shrubs, introduced from China and Japan, and like many other plants from those countries, seem perfectly at home here. They are profuse bloomers, with white flowers, very fragrant, opening in May and June.

Enanymus Americanus (Burning Bush), so called not from its inconspicuous purple flowers, but from the profusion of scarlet fruit or berries which hang upon the branches into winter. It grows eight to ten feet high, and has fresh and rather ornamental foliage. There is also a European variety.

Forsythia viridissima (Green Forsythia), so called from its deep green bark, is one of the very early flowering shrubs, blooming in April. Flowers bright yellow and very profuse. Should be transplanted in early spring or in autumn.

Hibiscus Syriacus (Althea, or Rose of Sharon), is a common flowering shrub, not perfectly hardy north of Massachusetts. Being a late bloomer, it comes in well when there is a scarcity of other flowers, and the hollyhock-shaped bloom, together with the regular handsome growing head, make it a desirable showy shrub, of easy culture, growing readily from cuttings, and is frequently used for screens or hedges. There are many varieties, single and double, white, red striped and pheasant eye.

Hydrangea hortensis, or changeable Hydrangea, is not perfectly hardy, even in this latitude; but is so showy a plant that it well repays putting a little straw or evergreen boughs about it in winter. It is a low-growing shrub, with broad leaves, and the large clusters of flowers are nearly white, when they first open in July, changing successively to a rose, pink and violet color, extending into August. The *H. quercifolia* is more hardy, bearing spikes of light colored flowers.

Juniperus suecica (Swedish) and *Hibernica* (Irish), are desirable evergreen shrubs, or dwarf trees, suited for planting near the dwelling. There are many other sorts which the amateur will plant out, but these are both hardy and of good habit. We prefer the Irish Juniper, though both assume a handsome cone like form, and may be sheared to fantastic shapes. They do best set out in May.

Kalmia latifolia (High Laurel), which all admire so much in its wild state, is well deserving a place among the shrubbery. It would be more common but for the difficulty of transplanting. Besides its unique saucer-shaped flowers of a light pink color, borne in clusters, the plant is a broad-leaved evergreen. It does

best in moist ground, partially shaded. It may be transplanted from open ground, if possible, by removing it with a ball of frozen earth attached, when it will usually live. In transplanting, add some muck or peat to the soil, where it can be had.

Kerria Japonica or *Corchorus* (Japan globe-flower), shoots deep green, three to four feet high, covered in June and July with double yellow globular flowers. It frequently blooms into September, is hardy, suckers freely; almost too much so to be kept within bounds. Transplant in April.

Lonicera Tartarica, Siberica, etc. (upright honey suckle).—The Tartarian is the more common sort, grows six to ten feet high, and blooms profusely in June. The flowers are followed by red berries, which also add to its ornamental qualities. It is entirely hardy, and of most easy culture. Set early in April.

Pæony Moutan (tree pæony).—A low growing shrub, blooming the last of May or early in June, and making a splendid show of large rose-colored, red, lilac and white flowers, from four to six or even ten inches in diameter. When in full flower the stems can scarcely be seen for the profusion of bloom. Some of the varieties are single, others double. They are increased by suckers and layers. Set early in April, as they start into growth very early.

Philadelphus coronarius (syringa or mock orange), is a strong-growing shrub with clusters of light colored, fragrant flowers, filling the air for quite a distance with agreeable perfume. Grows from six to ten feet high, and is entirely hardy, flowering in June and July. Set in early spring.

Rhododendron maximum catawbiense, etc., are the most desirable of all the broad-leaved evergreens, the glossy foliage being attractive in winter, while such a magnificent show of rich clusters of rose-colored bloom in June and July is found in no other plant. It does best in a partially shaded situation and a moist soil, but with care in transplanting, retaining a ball of earth about the roots. It may be grown successfully in a dry, exposed situation, digging the ground thoroughly and deeply about it. Many seedlings of great beauty have been obtained within a few years. By all means plant the Rhododendron, but not so near the house as to get reflection of the sun's rays. Transplant in April or May, always preserving a ball of earth about the roots.

Rhus Cotinus (smoke-tree or purple fringe), in its straggling, crooked growth, is not attractive, and the foliage is pretty, but the

flowers, or rather appendages to them—masses of a feathery or downy nature, greenish at first, but changing to a reddish tint, and afterwards to a brown or smoke color—give the whole a singular appearance. It grows 10 to 15 feet high, is hardy, and is easily increased by layers. It is sometimes called Venetian sumach, and in some countries is used for tanning and also for dyeing.

Robinia hispida (rose acacia) is an attractive little shrub of the locust family, growing from four to eight feet high. The pendant racimes of pea-shaped, rose-colored flowers are quite showy. The branches are covered with stiff hairs, giving them an odd appearance. They begin to flower quite young.

Rosa (rose).—It is almost superfluous to advise planting this queen of flowers. Every yard and garden should have a rose, if nothing more, and if there is scarcely a foot of ground, one of the climbing varieties, as Prairie Queen or Baltimore Belle, may be trained about the house. No other flower has received, in poetry and prose, half the attention bestowed upon the rose—large volumes have been written upon this single flower. But our purpose here is to advise planting them freely where space will permit. As single specimens or in clumps, along the borders or in the lawn, trained about the piazza to trellises, stakes, or pegged in a recumbent position upon the ground, the rose is equally attractive; and so great is the variety blooming at different periods, from June until October, that a respectable show may be kept from this genus alone. Plant a few of the June roses for their rich odors, more of the Remontants for their extended flowering season, some of the climbing and pillar roses to train about the buildings, a few standards for their tree-like form, also some of the Bourbon, Tree and Noisette, which, though not perfectly hardy, will, by their continual bloom, richly repay the little trouble of laying down and covering with earth during the winter. We cannot here pretend to give names, nor even the almost endless variety of colors, but one can hardly fail to be pleased with anything of the rose family. They are usually increased in the garden by layering and by dividing the roots. Florists propagate by means of cuttings placed in the greenhouse.

Spiræa.—There are many varieties of this beautiful flowering shrub. The *S. callosa*, *Reevesii*, *prunifolia*, etc., are among the best, though some of the newer seedlings are very desirable. Some are single, others very double. Color white, rose, lilac and

intermediate shades, the different varieties blooming from May until frost. The foliage of the *Reevesii* is quite pretty, let alone the clusters of snow-white flowers. They are all hardy, and easily propagated by layers and suckers. They grow from four to eight feet high, and a bed of spiræas, arranged in an oval form, with the taller growing sorts in the center, diminishing in height to the outer edge, makes an attractive collection of flowering shrubs.

Syringa (Lilac) is one of the oldest shrubs, but will always be a favorite on account of its early bloom and sweet perfume. The old sorts are partially giving way to the more delicate Chinese and Persian, which grow from four to six feet high, while the common (*S. vulgaris*) reaches eight to twelve feet in height. They bloom last of May and early in June, are very hardy, thriving with neglect, and are often employed for screens to out-buildings.

Thuja occidentalis, *Siberica*, etc., (Arber vitæ), though usually classed among evergreen trees, they are so slow of growth, and some of them so dwarfish in habit, we include them in this list. The common American is much used for evergreen hedges, and is also a good plant or tree for single specimens, or for screens about out-buildings, fruit-yards, etc. The Chinese is very pretty, but not perfectly hardy. In the Siberian, however, we have a dwarf, compact growth, perfectly hardy, and very desirable as single plants near the dwelling to relieve the monotony of winter. The *aurea*, or golden, is a beautiful, hardy plant. Set last of May or early in June.

Viburnum opulus (Snow Ball).—A strong growing shrub, growing from eight to fifteen feet high, and is an attractive object when covered with its large "balls" of snow-white bloom in May and June. It should not be crowded, as it is a rank grower, and may be increased by cuttings or layers.

Weigelia rosea is of comparatively recent introduction from China, and well deserves a place even in small collections. It is a profuse bloomer, flowers rose color, opening in May, is perfectly hardy, and readily increased by cuttings, layers, or division of roots. Set early in April, in any good garden soil.

Climbing Plants.

The flower garden is incomplete without some of those hardy perennial climbers. They should be planted near the house, in some situations in close contact, to be trained to the building, or what is better, to trellises, fitted up around the piazza and other

parts of the house. Trained to the building itself, the swaying of the branches wears off the paint, and the dense foliage retains too much moisture in wet weather. Rooted plants should first be obtained of the nurseryman or florist, after which they are readily increased by laying down the branches and covering with earth. Some of them grow readily from cuttings :

Ampelopsis quinquefolia (Virginian creeper, American Ivy, or Woodbine), is none the less desirable for growing wild in many parts of the country, often climbing to the tops of tall trees, fastening its tendrils, which become rootlets, into the rough bark. It is a rapid grower, preferring a moist soil, but succeeds well in dry places, and is a good plant to cover rough rock work or the side of a stone building. The flowers are of reddish green color, of not much account, the beauty being its foliage, which changes in autumn from a deep green to orange and scarlet, the tendrils and fruit stalks assuming the same rich color. It is entirely hardy, and is increased by cuttings and layers.

Clematis Virginiana, flammula, cœrulea, Hendersonii, etc. (Virgin's Bower).—These are rapid growing herbaceous, or partially woody climbers, with white, blue and mixed flowers, some of them very large and handsome. A few of the varieties are not perfectly hardy, and should be laid down and covered in winter. Growing ten to twenty feet in a season, they are well adapted for covering screens, walls, etc., and are ornamental in leaf and flower, while the common native sort (Virginiana) has curious masses of seed vessels with feathery appendages, giving it a singular appearance.

Hedera helix (European Ivy).—This woody climber, so prized by the Europeans for covering the stone walls of churches and other buildings, should be more extensively grown in this country. Beside being of a fine deep green color, the foliage frequently remains on during the winter. It clings to rough brick or stone walls without support, forcing its tendrils into the mortar. Brick work should not be painted if to be covered with ivy. It is a rapid grower, and in a few years will cover the entire walls of a lofty building.

Lonicera Belgicum brachypoda, Canadensis, coccinea, sinensis, sempervirens, etc., (Twining Honeysuckle).—These are all fine woody climbers, and should be in every yard. If there is room for only three climbers, let one be a Striped Monthly honeysuckle, one a Wistaria, and the other a climbing rose. The L. *Belgicum*,

or Striped Monthly (Belgian), is highly scented, filling the air with fragrance. The *Sinensis* (Chinese) is also fragrant, and nearly evergreen. Both of these are fine for training about the pillars or lattice work of a piazza, or for covering a screen around out-buildings. They are all hardy, and grow rapidly from cuttings or layers.

Tecoma radicans (Trumpet Creeper).—This rapid growing woody climber was formerly called Bignonia, and is still so classed in many catalogues. The large trumpet shaped scarlet and orange flowers, born in clusters from July until frost, render this plant an attractive object. The *grandiflora*, or Chinese, is not perfectly hardy at the North, but endures the winters in this latitude without protection.

Wistaria sinensis, brachypoda, magnifica, etc.—The *sinensis* or Chinese, is the variety mostly cultivated, and is one of the most desirable woody climbers, reaching the tops of the loftiest houses, and putting out its racimes of fragrant blue flowers in May before the leaves start. It is a profuse bloomer, and freqeuntly flowers the second time in August. It usually grows fifteen to twenty feet in a season and is much used in cities, trained to brick walls, or over piazzas. There are several new seedlings of promise. They are increased by cuttings and layers.

Vegetable Garden.

If the garden spot is not selected, choose a warm, dry plot near the house. If naturally drained all the better, but if not, underdrain with stone or tile. Very gravelly and stoney soil will not allow the free germination of seeds without much labor in clearing or carefully covering with fine earth brought from a distance. Stiff clay beside being cold and wet, bakes in dry weather, and prevents many seeds from coming up. A lightish, fine loam between these extremes is best. Still it is often desirable to have the garden in a particular locality, and a little labor in clearing off stones and carting clay upon a gravelly soil, and adding muck or fine sand, to clayey land, will make a good garden almost anywhere, provided drainage is attended to and the soil well manured and plowed deep and thorough. A garden made too rich is a rare occurrence; still we have seen too much horse manure added year after year to a light soil. It served to make it still lighter and too dry, with not sufficient texture. Mixed, or cow manure would be better for such soils. Horse manure is just the thing to lighten a heavy soil. Farmers' gardens get too little,

rather than too much manure. Market gardeners make the ground black with it every year, and get two or three heavy crops annually from the same ground. Having manured the ground heavily with stable, barn-yard or hog manure—the three combined are excellent—plow deeply, and either subsoil or run the common plow the second time in the furrow to deepen the soil. Vegetable gardens are usually too hastily plowed in the hurry of other work. The soil should be completely broken and made so fine that the myriads of little rootlets can penetrate through every part of it; hence a second, or cross-plowing will pay well, then harrow down finely. Where the garden is not too large, forking or spading it up is better than plowing, and where there are strawberry and asparagus beds, rhubarb, currants, raspberries and other small fruits, beside the dwarf and other fruit trees, it is often necessary and always desirable to spade up, and a fork-spade is the best implement to do it with. To attain the best results, the ground should even be trenched, or spaded two spits deep, mixing manure well through the whole. Once trenching in this way answers for years. Farmers, with their hundreds of acres, will smile at the idea, but market gardeners, who cultivate land worth $500 to $1,000 and more per acre, find their account in it. Even a farmer's garden ought to yield the family a large portion of their living, rather than the few imperfectly grown vegetables too often seen there. Remember, too, that no after care or labor can make up for imperfectly preparing the soil and bad planting.

Having prepared the ground, the next thing is to lay it out, and this will depend somewhat upon the shape. As a general rule, be the garden square or oblong, it is best laid out with a main walk three feet wide through the center, and lesser walks around the sides three feet from the outer edge, thus leaving a fruit or other border upon each side next to the fences. These may be set with currants, raspberries, blackberries, grapes, gooseberries, etc., or planted with tomatoes. The remainder of the garden may be divided by cross-walks as desired. It is not advisable to plant everything in beds, as the waste by so many walks is not compensated by any advantage. The vegetables may be planted in rows across one of the plots, and there is no necessity for a division between the sorts, a row of beets being next to a row of turnips, &c. In most cases it is well to plant or set the strawberries, raspberries and other fruits, also rhubarb and asparagus, wholly upon

one side of the garden, so that the plow may be used upon the other side if desirable.

In covering vegetable and other seeds it is better to use the *back* of a rake, or the foot, pushing the dirt directly across the row. The teeth of a rake, drawn lengthwise, will cause lumps and small stones to roll in first upon the seed. If it is desirous that the ground have a neat look after the work is done, the rake-teeth may be drawn lengthwise after the seeds are covered. Where it is an object to have every seed vegetate on stony or lumpy soil, bring fine earth from another place in a basket, and strew on by hand.

Asparagus is best obtained from the nursery or seedsmen, getting good strong one year old roots. Set in either spring or fall in deeply worked, rich soil. Too much manure can hardly be added to this vegetable, and the *giant* sort is made so by manure. After digging in a liberal dressing, open trenches 16 to 18 inches apart, 18 inches deep, and fill in a foot of manure mixed with earth, cover this with earth, and set the roots 8 to 10 inches apart and cover with three inches of soil. Keep free from weeds and cover with a coarse manure in the fall, both as a partial protection and that the leachings shall further enrich the soil. The coarse part should be raked off in the spring and the fine forked in, using care not to injure the crowns. A few chicken coops in the vicinity of the beds will keep the beetles in check. The second year will give a partial supply, after which a full crop will be had. Cutting should not be continued more than four weeks, else the plants will be weakened. The roots are easily raised by sowing seed thickly in drills one foot apart, covering one inch. Transplant as above when one year old. No garden is complete without its asparagus bed, and when well established and properly cared for, it is good for 30 years.

Beans.—Three, or at most four, of the many kinds catalogued are enough for the garden, and being somewhat tender should not be planted very early—usually the first week in May in this vicinity, though from appearance they might safely have been planted the 25th of April this year. Early Valentine, or Six Weeks, and Refugee, or Thousand to One, will answer well for the early snap or string sorts, requiring no poles, and the London Horticultural (speckled cranberry) and Large White Lima are the best pole or running beans for using when shelled green. All kinds do best on a light, warm soil, and should not be planted

until the ground has become well warmed in spring, as a frost after they are up is pretty sure death to them. Plant the bush sorts in rows 2 feet apart, hills 15 inches apart, with 5 or 6 beans to a hill, leaving four when thinned out. Cover with one inch fine soil. It is well to plant at several different periods, even into July, to keep up a succession. Limas should be stuck in the ground eye down, as the broad lobes cannot well turn in the soil to reach the surface. Make the soil soft and light, plant in hills 3½ feet apart each way, from May 1 to 15, depending upon the season—in no case when the ground is cold and wet. Cover with half an inch of soil. It is always better to make up the hills and set poles six to seven feet out of ground, before planting the beans. Use an iron bar to set the poles, putting them in firmly. Plant six to eight good beans around each, leaving three or four strong plants to grow. The Horticultural beans may be planted three feet apart, and a little earlier. They also require poles; or both these and Limas may be trained upon strings or a trellis. Keep well hoed.

Beets.—Two, or at most, three, kinds are enough for the garden. The early Blood Turnip Rooted suits us, though some prefer the Bassano for the earliest. The Long Blood is the best for general winter use. Sow on a light, rich soil about the middle of April for the earliest—the 10th this year—and they may be used by the 1st of July. For the general crop of winter beets, sow from the middle of May to June 15. These will grow quicker—hence more tender—and larger than the early sowings. Let the drills be 18 inches apart, made with a pointed stick or a bayonet hoe; drop the seed one inch apart and cover with half an inch of fine soil. When four to six inches high, thin to six inches apart, using the tops and roots of those pulled out for greens. In pulling for the first early, take every alternate root, leaving the others one foot apart. The late sorts should be left about nine inches apart at the first thinning. Beets, as well as other vegetables, are usually left too thick. Radishes may be sown in the drills with beets, to be pulled for use before the beets are of much size.

Cabbage.—There is a large list of varieties to select from, but for the ordinary farmer, two or three kinds are sufficient, as the early York, or Winningstadt, for early, and the large Bergen or Drumhead for late varieties. The Marblehead is also recommended for size, and the Stone Mason for solidity and trustwor-

thiness. The early sorts are usually sown in a hot-bed in March—sometimes in February—so as to have plants ready for setting out in April, particularly in the vicinity of good markets. Cabbages do not head as well in the heat of summer, hence the first crop is got in quite early, and the main or late crop is sown the middle or last of June. The early sorts are also sown about the middle of September, and transplanted to a cold frame the last of October, covering with boards in severe weather. Seed is sown thickly in drills, one foot apart, and covered with one-half inch soil, well pressed down. A warm, light and moderately rich soil suits the cabbage family. As hog manure is reputed to impart "club-foot," it is safest to omit it. Wood ashes are good for cabbages. Dig or plow the soil one foot deep and set early plants about the middle of April, in rows two feet apart and 18 inches distant in row. The late, large-growing sorts should be 2½ by 2 feet. In transplanting it is often customary to set a lettuce plant between the cabbages, which will be ready for use before the cabbages require the whole ground. Frequently stirring the soil greatly benefits this crop. Coleworts, Turnip Cabbage, Brussels Sprouts, Kale, Broccoli and Borecole are all varieties of the cabbage family, requiring about the same treatment. The whole family usually head better by being transplanted.

Carrots should have a large place in the garden, and if more are raised than the frequent demands for the kitchen require, the balance will furnish the best of cow or horse feed. Two kinds are enough for family use; the Early Horn, a sweet, tender, early sort of small size, and the Long Orange for the main winter crop. The Early Horn will frequently give a good yield sown in July, after early peas or onions; but for early use should be sown in a warm, rich, deeply-worked, fine soil, the first to the middle of April. Let the rows be one foot apart, scatter in plenty of seed, cover one-half inch deep with fine soil, and thin to four inches at the second hoeing. The Long Orange grows larger and does best in rows 15 inches apart, thinned to 5 inches. There is little danger of making the soil too rich or working it too deep for this tap-rooted crop. Keep well hoed and wed, especially while small. The main crop may be sown from the middle of April to the first of June—better early in May.

Cauliflower.—This delicate and popular vegetable is of the cabbage family, and the directions already given will apply equally

well for this branch. Frequent waterings will facilitate the heading or flowering.

Celery is yearly growing more and more in favor. It is not necessary to start the plants in a hot-bed, as they do best grown the latter part of the season and blanched in cool weather. Seed sown in drills, one foot apart, in the first half of June will furnish plants for setting out the first half of July. One-fourth inch is deep enough to cover this fine seed. Transplant during a wet day, if possible, setting the plants in trenches six to eight inches apart. The trenches, or rows, should be three feet apart, to afford earth to bank up with. Fifteen inches in depth and one foot wide, forms a good trench, throwing the earth out between the rows. Fill in six inches of well rotted manure, and the thrown out earth, equal portions, and in this set the plants, covering and shading if in hot, dry weather. Keep well hoed, and work in a little of the surface soil occasionally, leaving most of it to be returned early in October, when the stalks are carefully gathered up in the hand and tied with soft strings, or straw, and the finely pulverized soil returned carefully about them, avoiding bruises, and not allowing the earth to get in the centre of the plant. Some persons wrap the plant with a newspaper to prevent the earth from getting into the centre. Leave banked earth in a cone form, to turn water. A second earthing may be given late in October, and they will be finely blanched in a few weeks. Earthing up is sometimes, but improperly, done each fortnight during the growing season. Stalks should be grown in the air, and then blanched.

Cucumbers—There are many varieties of this running plant, but the Early Frame, White Spine, and Long Green are all good and sufficient for ordinary gardens. They do best on a rich soil. Plant where they are to remain, the last of April or early in May, and at any subsequent period until the middle of July, the late plantings for pickles. The hills should be four feet apart; have some well rotted manure dug in with the earth, and ten or twelve seeds planted half an inch deep in each. After going through the attacks of bugs, thin to three strong plants in a hill. Wooden boxes with no covers, placed over the hill will keep off bugs. A dusting of snuff or pounded tobacco is also effectual. Radishes or lettuce may be raised between the hills, to be removed before the vines cover the grounds. Cucumbers are often finely grown by planting in a tub or half-barrel, partly filled with manure, putting six inches of dirt on top, and setting it near the kitchen to receive the

slops thrown out. The barrel should allow the water to pass out at the bottom.

Egg plant, though of comparatively recent introduction is annually growing in favor. It requires a long warm season to mature it, hence should be sown in a hot-bed. Most persons procure plants grown by professional gardeners, or those having hot-beds, setting them in the open ground about the middle of May, two feet apart each way. The ground should be rich, light and *warm*, and if well tended the result will be a full crop of large eggs. Like the cucumber, they are to be eaten green but not raw. We prefer them sliced thin and pared over night; sprinkle a little salt on each piece and put in a plate. Pour off the dark liquid extracted, and fry brown in lard, first dipping each piece in a batter of eggs.

Sweet corn should find a place in every vegetable garden, unless more space is allowed it elsewhere. Plant early varieties the last of April or very near the first of May, and later sorts the middle of May, first and middle of June, to keep up a succession, covering one inch in rows three feet apart. It will also come to maturity planted up to the 10th of July. In its season the kitchen may properly make large and frequent drafts upon the green corn, boiling the ears, making puddings and succotash, and drying a goodly quantity for winter.

Lettuce.—If there is a hot bed, sow seeds for early heads, to transplant about the middle of April. Being very hardy, it is frequently sown in September and pricked out in a cold frame, to be covered during the winter. To keep up a succession, sow in the open ground the middle of April, May, June and July; in drills one foot apart, and thin the head or cabbage sorts to six inches. Growing quickly, they may well be transplanted between cabbages, cucumber, squash and melon hills, perfecting themselves before they are in the way. Cover the seed lightly; usually one-fourth inch is sufficient except in very dry weather. Lettuce heads best in a moist soil or during wet seasons. The Consorts are not favorites with us, but Tennis Ball, Early Cabbage or White Butter Dutch cabbage and White Silesia are good sorts.

Melons.—These require a rich soil and good culture, their treatment being similar to the cucumber, save that the watermelon, which runs to a greater distance, should have the hills six to eight feet apart. Though the ground be rich, it is well to excavate a large hole and work in a half bushel of old manure to each hill, mixing it well with the earth. Hog manure is excellent for this

purpose. The old yellow muskmelon has give place to the better green sorts, among which are Netted Citron, Skillman's and Allen's Netted, Persian and Japan, all good varieties. Among the watermelons, the Spanish, Mountain Sweet and Long Green, are desirable sorts. These cucurbitaceous plants are liable to become hybridized by bees and insects if grown together, hence it is best to plant each sort by itself.

Onions are raised from three kinds of seed or bulbs, viz: the ordinary Black Seed, the Top onion, where each small bulb grows to a large one, and the Potato onion, where the bulb cracks or splits open as it grows and forms two to four bulbs in a cluster. The soil for onions should be made very fine and rich, worked deep, and if lime, ashes or salt be freely incorporated with the soil, the maggots will be less troublesome. Rake the ground to remove stones, lumps of dirt, &c.; and sow about the middle of April in drills one foot apart, covering one-half inch and thin to four inches. The Red and White Globe are among the best sorts. The Potato and Top onions may be set out at the same time in rows one foot apart and four inches distant, just covering the crown. They will be fit for pulling in July, and may be entirely removed in August for late turnips or cabbages. In common with other vegetables, they should be kept free from weeds. The Top and Potato sorts may be grown where the maggot destroys those raised from the seed. Hot water poured along the row from the spout of a tea-kettle is the best remedy for the worms when at work.

Parsneps require a *deep* rich soil in which to perfect themselves. Grown in a muck swamp, they attain the length of two feet and more. Cover the thin seeds one half inch, sowing from the middle of April to the middle of May, in drills eighteen inches apart, and thin to six inches. They are improved by freezing in the soil, hence after digging what are wanted during the winter, leave the rest in the ground until spring. The Sugar or Hollow Crown is the best sort.

Peas are in such great variety, it is difficult to make a selection. Two, or at most, three sorts are sufficient for ordinary farmers. The Daniel O'Rourke, or Prince Albert will answer a good purpose for the first early, after which we want nothing better, if indeed a better pea can be found, than Champion of England. If not convenient to stake or bush, sow Bishop's Dwarf. Tom Thumb, or Strawberry; but the tall varieties well repay bushing.

Enduring considerable cold, the early peas should be put in by the first of April—in some seasons by the middle of March. The late sorts may be sown the middle of April, May and June to keep up a continuous supply, though when covered deep in a *dry, light* soil, or afterward banked up some inches, they will continue to yield pods for a long time. Some sow broadcast, but we want *everything* in rows or drills that they may the more readily be kept free from weeds. Our plan is to sow on deeply worked but not over-manured ground, scooping out the width of a hoe, six inches deep, the rows three feet apart for dwarfish sorts, and four feet for the tall kind. Scatter in quite thickly the dwarfs about one inch apart in each direction, and the Champions two inches. This is much thicker than usually advised, but a trial will show its advantage in an increased yield. Cover with two inches of the soil and insert the brush. Continue to return the earth as the peas grow, until the ground is level or even ridged up against the vines. They will be less liable to mildew and bear longer for having the roots so far below the surface.

Potatoes.—A few early potatoes should be planted in the garden, to be handy for the kitchen. Plant in rows two and a half feet apart, drilling in halves, or, if large potatoes, quarters, one foot apart, and cover with three inches of soil. Unless the ground is rich scatter some manure in the furrow, or otherwise open drill. Plant from first to middle of April.

Sweet Potatoes may be raised successfully by setting out the plants obtained from a grower. To prevent a long straggling growth spread rows of manure, three feet apart, and turn furrows or throw earth over it with a spade, forming ridges six inches high of fine soil. Set the plants fifteen inches apart along these ridges, and keep well hoed, earthing up in the early stages of their growth. Lift the vines a few times when they incline to root. Set the plants from 10th to 20th of May. The slips for setting out may readily be obtained by planting the tubers in a hot bed from the 10th to the 15th of April. Dig down and carefully break off the shoots close to the potato, replacing the earth for a second crop of sprouts. Transplant in wet weather, if possible.

Radishes contain very little nutriment, and some persons incline to banish them from the table as unhealthy. We leave that—relishing crisp, quick grown roots freshly drawn from the ground. They may always be grown among potatoes, beets, in cucumber or

melon hills, or between them, also between rows of corn, &c., thus taking no ground for themselves alone. Sow each fortnight from the first of April till August, on warm, light soil, the newer the better, covering half inch deep, and thin to two inches. Our preference is for the Olive-shaped, or Half Long Red—next to that the Long Scarlet.

Rhubarb is best grown along the border of the garden or in rows through the center, three feet apart. Ten to twelve roots will furnish a good family supply. The soil can scarcely be too rich for rhubarb. Set roots or single crowns of Linnæus or Victoria from the 1st to 10th of April, covering two inches deep. When established, the stock is easily increased by cutting off a few crowns from each plant, with a spade. No garden is complete without its rhubarb. Keep the blossom buds picked off to induce stalks, and in pulling draw *from* the center, so as not to injure the crown. Beside being rich the ground should be deeply and finely dug about the roots, using care not to unduly mutilate them.

Salsafy and Scorzonera, or White and Black Oyster Plant.—These vegetables are more highly esteemed the more they are known. Though not up to the bivalve, they form a very good vegetable substitute. Sow from the middle of April until May 15th, on deeply worked rich soil, in rows one foot apart, covering half an inch. Thin to three inches and keep well hoed. The roots are best in the spring after standing in the ground during the winter, the same as parsnips. Bury a few in earth in the cellar for use when the ground is frozen. The black variety, or Scorzonera is most prized by Germans.

Spinach makes the very best, as well as earliest spring "greens." It endures the winter with a slight covering of straw or other litter, and on this account the early crop is sown from the first to the middle of September, in rows ten to twelve inches apart, half an inch deep, thinning to four inches before winter sets in. The surplus plants may be used late in the fall, and the remainder may be uncovered and used during tne winter if desirable. A thin covering of straw is better than a thick covering, which smothers the plants. Uncover as soon as hard freezings are over in the spring, and when of sufficient size pick off the leaves, and others will soon appear to keep up the supply. It may be sown in spring, at intervals of a fortnight, from the middle of March until the middle of July. The round-seeded is best for spring sowing. The prickly is recommended for standing the winter best, but we find no

trouble with the former, and prefer its thicker leaves. The fall sowings may be cleaned off in season for spring crops of various kinds.

Squashes.—Three, or even two, of the numerous kinds are sufficient for the farmer's use—the Early Bush, Yellow Crook-neck for first, and the Boston Marrow for fall and winter use. The round or pan-shaped bush is a little the earliest, but not as good as the Yellow. The Hubbard is also a good keeping or winter sort. The squash has to run the gauntlet of so many insect enemies that in some localities its culture is given up. If it survives the persistent attacks of the striped bug when first up (the running squashes being a dainty morsel for these "yellow-jackets"), it is next seized by a large, dark brown, "odoriferous" bug, while one species of the "lady bird" pays addresses to it; and if it escapes these, a traitorous insect stings it near the root, and the resultant "borers" finish it. The summer varieties, coming forward early, in part escape these insects. Plant them in hills four feet apart, and cover half to three-fourths of an inch. When past the attacks of the striped bug, thin to four plants in a hill. The running sorts should be six to eight feet apart, treated in the same way. Soot and tobacco dust are good applications to keep off bugs. Small wooden boxes, with or without glass-covers, are a protection. Hand pick the "stinking bugs," but the borers we generally succumb to, though they may sometimes be cut out with a knife and not kill the plants. All squashes want a warm, rich soil, and the faster they grow the better they overcome their enemies.

Tomatoes, from being curiosities a few years ago, are now indispensable to every garden. For first early, sow in a hot bed, or procure plants to set out the first of May. Seed sown in any position, middle of April or first of May, covering half an inch, will furnish plants for a later crop. Set in a finely-worked soil along the borders, three feet apart, or in rows that distance from each other. They are among the easiest things to raise, a volunteer crop being sure to come up where they were grown the previous year. Some prefer tying to stakes or bushing them, but we let them take their own course. The large smooth red and Fejee are the best sorts—the latter for our use.

Turnips.—Sow the red top, or other flat sorts in drills two feet apart, covering one-fourth inch, middle of April to middle of May, for early, and middle of July to August 15th, for late fall crops.

Thin to eight or ten inches, and then pull out each alternate root for use, when half grown. Rutabagas or Swedes do best sown from the 10th to the 20th of July, in the same manner, though a few may be sown in April for early use. Like the carrot, if more are raised than wanted in the kitchen, they will find a ready market at the barn. Use plenty of seed to feed the little black beetles and still have plants enough left. Make the soil rich and light.

In conclusion, I append the following tables, which will be invaluable to the farmer, or to any person who cultivates the soil :

TABLE, *giving the names of various Seeds, and the amount of Ground they will occupy.*

Kinds of seeds.	Amount of ground sown.	
Asparagus	One ounce will sow a bed 4 feet square.	
Beans, dwarf	One quart will be sufficient for a drill 250 feet long.	
Beans, kidney	One quart will plant about 350 hills.	
Beans, Lima	One quart will plant about 100 hills.	
Beet seed	One ounce will sow one square rod.	
Borecole	One ounce will sow a seed bed 4 by 18 feet.	4,000 plants.
Brussels sprouts	One ounce will sow a seed bed 4 by 18 feet.	
Broccoli	One ounce will sow a seed bed 4 by 18 feet.	
Cabbage	One ounce will sow a seed bed 4 by 18 feet.	
Cardoon	One ounce will sow a drill 100 feet long.	
Carrot	One ounce will sow a bed 4½ by 30 feet.	
Cauliflower	One ounce will sow a seed bed 4½ by 20 feet.	5,000 plants.
Celery	One ounce will sow a seed bed 4½ by 20 feet.	
Celeriac	One ounce will sow a seed bed 4 by 36 feet.	
Cress	One ounce will sow a bed 4 by 6 feet.	
Cucumber	One ounce will plant 100 to 125 hills.	
Egg-plant	One ounce will sow a seed bed 4 by 20 feet, 2,500 plants.	
Endive	One ounce will sow a seed bed 4 by 20 feet, 3,500 plants.	
Leek	One ounce will sow a bed 4 by 8 feet.	
Lettuce	One ounce will sow a seed bed 4 by 40 feet, 2,500 plants.	
Melon canteleup	One ounce will plant 75 hills.	
Melon, water	One ounce will plant 30 to 40 hills.	
Mustard	One ounce will sow for greens a bed 4½ by 10 feet.	
Nasturtium	One ounce will sow a row 25 feet long.	
Okra	One ounce will sow a row 100 feet long.	
Onion	One ounce will sow a bed 4 by 75 feet.	
Parsley	One ounce will sow a bed 4 by 50 feet.	
Parsnip	One ounce will sow a bed 4 by 60 feet.	
Peas, smaller sorts	One quart will sow a row 300 feet long, 1 inch apart.	
Peas, larger sorts	One quart will sow a row 250 feet long, 1½ inches apart.	
Pepper	One ounce will sow a seed bed 4 by 20 feet, 1,500 plants.	
Pumpkin	One ounce will plant 25 hills.	
Radish	One ounce will sow a bed 4½ by 12 feet.	
Rhubarb	One ounce will sow a seed bed 4 by 50 feet.	
Salsify	One ounce will sow a bed 4 by 8 feet.	
Spinach	One ounce will sow a bed 4½ by 30 feet.	
Sea kale	One ounce will sow a bed 4 by 10 feet.	
Squash, summer	One ounce will plant 50 hills.	

Kinds of seeds.	Amount of ground sown.
Squash, winter	One ounce will plant 20 hills.
Tomato	One ounce will sow a seed bed 4 by 20 feet, 1,200 plants.
Turnip	One ounce will sow a bed 4½ by 100 feet.

70,000 kernels of corn in a bushel; 254,000 apple seeds in a bushel; 15,000 seeds in an ounce of tobacco.

Garden Seeds.

Asparagus	One ounce will give 250 plants.
Beans, dwarf	One quart per drill will give 200 feet long.
Beets	One ounce will give 200 plants.
Cabbage	One pound will give 70,000 plants.
Carrot	One ounce will give 800 plants.
Cauliflower	One ounce will give 4,000 plants.
Egg-plant	One ounce will give 1,800 plants.
Melon	One ounce will give 50 hills.

Quantity of Seed per Acre Sown in Rows or Drills.

Beans, field, in rows 2 feet apart	2½	bushels.
Peas	2	bushels.
Potatoes, in rows 3 feet apart	12	bushels.
Onions, in rows 12 to 15 inches apart	4	pounds.
Carrots, in drills 2 feet apart	3	pounds.
Parsnips, in drills 2 feet apart	2½	pounds.
Beets, mangel wurtzel, 2 feet apart	4½	pounds.
Indian corn, in rows 3½ feet each way	8	qts. per acre.

Broadcast.

Wheat			1½	bushels.
Barley			2	bushels.
Rye	1¼	to	2	bushels.
Oats	2	to	4	bushels.
Buckwheat	1	to	1½	bushels.
Indian corn	2	to	2½	bushels.
Peas			3	bushels.
Flat turnip			1¼	pounds.
Hemp	1	to	1½	bushels.
Flax	½	to	2	bushels.
Timothy	12	to	24	quarts.
Mustard	8	to	20	quarts.
Red top	12	to	16	quarts.
Red clover	10	to	16	pounds.
White clover	3	to	4	pounds.

Kentucky blue grass	10 to 15	pounds.
Rye grass	10 to 16	pounds.
Orchard grass	20 to 30	pounds.

Plants at given Distances in a Square Rod.

Inches asunder.	No. of plants.
4 by 4	2,450
5 by 4	1,960
6 by 4	1,633
6 by 6	1,069
8 by 6	816
8 by 8	612
10 by 8	490
10 by 10	292
12 by 12	272
15 by 10	261

Plants for an Acre of Land.

Distances—feet.	No. of plants.
1	43,560
1½	19,360
2½ by 1	17,424
2½ by 1½	11,616
2	10,890
2½ by 2	8,712
2½	6,969
2½ by 3	5,808
3	4.840
2½ by 3½	3,978
3½	3,556
4	2,722
4½	2,151
5	1,742
5½	1,440
6	1,210
6½	1,031
7	889
7½	774
8	680
8½	602
9	537
10	435

Distances—feet.	No. of plants.
12	302
14	222
16	170
18	134
20	108
22	90
24	75
26	64
28	55
30	48

TABLE, *Showing the Number of Trees required to plant an Acre, from one to fifty feet apart.*

Feet.	Trees.
1	43,560
2	10,890
3	4,840
4	2,722
5	1,742
6	1,210
7	889
8	680
9	437
10	535
11	360
12	302
13	257
14	222
15	193
16	170
17	150
18	134
19	120
20	108
21	98
22	90
23	82
24	75
25	69
26	64
27	59
28	55
29	51
30	48
31	45
32	43
33	40
34	37
35	35
36	32
37	31
38	30

Feet.	Trees.
39	28
40	27
41	26
42	24
43	23
44	22
45	21
46	10
47	19
48	18
49	18
50	17

Hatching Eggs by Artificial Heat.

Mr. W. H. Smith, Dover, inquired whether "eggs can be hatched in any manner by artificial heat by any person of small means." They can be hatched, but the operation would not be sufficiently practicable to pay. "Would a tight box four feet high answer, the heat being supplied by oil lamps, in an even manner, so that the temperature could be kept at a given point? At what point should the mercury stand to hatch successfully? Do hens turn their eggs during the period of incubation?"

Mr. Solon Robinson.—Ure's Dictionary of Arts, &c., also gives all the particulars about artificial incubation. The mean temperature required is 100° Far., varying from 95° to 105°, and in some cases heat has been suspended two or three hours without injury. This degree of heat may be kept up by any convenient process—by fire, steam, hot water, chemical action, or animal bodies, so it is even and continuous; and the eggs may be placed in a large room, or small, close box, of wood or metal, or in a clay oven, as they are in Egypt.

Mr. S. Edwards Todd stated that it is essential that eggs, during the period of incubation, should be exposed to pure air, as air well charged with aqueous vapor is eminently better than warm and dry air. Egg shells are porous. The chicken in embryo could not survive and be developed were the egg kept warm in a vacuum.

The chairman enquired of Mr. Todd if birds do turn their eggs while sitting.

Mr. S. Edwards Todd stated that all female birds that are good nurses turn their eggs over, sometimes every day. Geese, ducks, turkeys and fowls of the air, all turn their eggs over occasionally. He had seen them do so. If you mark the upper sides of the eggs it may be seen the next day, or in a few days afterward, that

they have all been turned over. Female birds do it instinctively. Instinct has done more for female birds than science has for us. Were the eggs not turned over during the process of hatching, the contents would settle on one side of the shell, and adhere to the inside, to the destruction of the embryo chicken. For this reason hens' nests should not be made so deep that the fowls cannot turn their eggs over readily.

Asparagus—When to Cut.

A member inquires "when to cut asparagus—above or below the surface, white or green? Does cutting injure the bed?"

Mr. Wm. R. Prince.—No man of sense, who knows the difference, will ever buy white asparagus, and much more cut it from his own bed, when there is no green to the stalks, which is really the only valuable portion. The fashion here is to cut it all below the surface, because the city taste demands it, and to gratify it, the cultivators run the risk of injuring their beds, which the practice does, if long continued. Country people who grow asparagus for their own use, should learn never to cut it below the surface, nor try to eat the white stalks.

Long Island Land.

Mr. William Turner wants to emigrate from Camden, N. Y., to the sea shore, and wants the Club to tell him whether Long Island lands are as good as those of Hammonton and Vineland.

Mr. S. B. Nichols, of Hammonton, N, J., said that he would not draw the comparison between the two localities; he would only speak of Hammonton as it is, in the most encouraging terms. Their prospects never looked more favorable—even peach buds, which were thought killed, are blossoming, and strawberries and all other fruits give good encouragement. Settlers, too, are constantly arriving and making locations, and Mr. R. J. Byrnes, the proprietor of the vacant lands, has just purchased 15,000 acres additional, which he is preparing for sale in lots to suit purchasers. It is now certain, with the aid that you have given, this wilderness portion of New Jersey is sure to be occupied.

Mr. Wm. R. Prince.—My opinion has always been favorable to the settlement of that part of Jersey. I wrote and published years ago a list of fifty plants that could be profitably cultivated upon those light lands. All that is wanted is the hand of man to make them productive. The same thing is true of the neglected land in the interior of Long Island.

Mr. John G. Bergen.—Much of the land on Long Island is not light—it is a strong clay or loamy soil. It is better, on the whole, than the light lands of Jersey, of which I have heretofore spoken in high terms. It is remarkable for its productiveness of fruits.

TRICHINA.

Andrew Bush, M. D., Setzler's Store, Chester co., Pa., writes: "The fact that the trichina has been discovered in this country should cause no alarm. It is nothing new. The great improvement in microscopical instruments has enabled us to discover many things heretofore hidden. It is only in occasional diseased conditions, probably, that these worms are found in quantities sufficient to endanger human health. Hydatids and other species of animalculæ are often found in the viscera of hogs, cattle and sheep; yet the healthiness of other portions of the animal has never been disputed. To prevent the spread of trichiniasis or other diseases, farmers should endeavor to keep their animals in a healthy condition. Exhaustion produced by exposure to cold winds, or over heated bodies, insufficient food or irregular feeding, predisposes all animals to infection. The three avenues by which contagious and epidemic disease enter into the animal system, are the internal pores of the alimentary canal, the inhaling surface of the lungs, and the external pores of the skin. Of these three avenues, the first is the most important; it can be guarded and controlled by the farmer's hand. Stagnant water should never be given to animals. The rule should be, pure water to drink, and wholesome, nutritive food to eat; never gorging to satisfy, as that produces debility; never omitting to feed at the proper time, as then the stomach becomes empty, the mucous coats or lining collapse and soften, and a suitable place is formed for the deposit and development of trichina and other animalculæ. A quantity of food in the stomach dilutes all poisonous matters, and makes it less injurious. An empty stomach ceases to nourish, and the cessation of nutrition is the beginning of dissolution.

"The stomach is the animal furnace that consumes the carbon of the food to generate animal heat, and gives power to the heart to circulate the blood, gives power to the lungs and skin to perform their important functions in building up and preserving the body and throwing off injurious matter. German writers recommend coal oil mixed with the hog feed in small quantities, and applying as a wash externally, as preventives of trichina. Feed-

ing flour of brimstone, mixed with salt, to horned cattle and sheep, as a preventive of animalcular and insectivorous diseases, has a well-spread and established reputation. The external application of pine tar to the mangers, feeding-boxes, water troughs and muzzles of animals, experience has proved useful. I recommend pulverized camphor, mixed with coal tar, reduced with coal oil to the consistency of paint, to prevent disease in stables."

The Prairie Farmer, Chicago, says: "Of many hundred specimens of pork which have been examined by scientific men of this city, one in every fifty have been found more or less infected. Let this, however, cause no alarm, for it only proves pretty conclusively that with the same thorough investigation the worms would have been found years ago, and there is no reason to suppose that there are more now than there have ever been. Some of the deaths in the army may have been caused by eating raw pork, particularly those cases of diarrhœa and fever which were accompanied by irritation and soreness of the muscles; but in a country where meat is as thoroughly cooked as it is in ours, there is little to be feared from this scourge. Therefore, let all those who are lovers of pork, and still have plenty on hand, not get panic-stricken and 'throw the meat to the dogs,' or even desist from using it; but console themselves with the idea that they have probably eaten infected pork long before they knew anything about trichina, and they may do so again with perfect impunity, so long as they are cautious about having it thoroughly cooked. Discard all raw pork in any shape whatever, and always bear in mind that this trichina dies at a temperature of 160°, which is 62° below the boiling point."

Is Pork Unwholesome?

Dr. Flint gives a few facts in answer to some of the theories of anti-pork eaters about its unwholesomeness as food. "My father was of a consumptive family, but regular in his habits, diligent in business, a pork-eater all his life, and died from a billious attack when seventy-five years old. My mother, now eighty-three years old, and with ample vitality to indicate an additional earthly sojourn of ten or fifteen years, has, always been a hearty pork-eater, and still eats of it with a relish daily. My maternal grandmother was a life-long pork-eater, and died aged ninety-six years. I am now fifty-five years old, have endured as much exposure perhaps as any man of my age in the State, have always indulged bountifully in

pork-eating, have not a tinge of scrofula in my composition, and expect to live to be 100 years old, or thereabouts, unless killed by a bilious attack (overeating), or accident. So much for individual examples, of which I have intimate knowledge. Where do we find the greatest degree of health, the most energetic vitality, and consequently the greatest longevity ? In the country, among pork-eaters. Where do we find the greatest amount of scrofula ? In the cities, where beef, mutton, game, fowl, and fish are freely used, and pork only occasionally.

"Where do contagious, epidemic, and asthenic diseases, such as small pox, cholera, typhoid and typhus fevers, most prevail ? In the cities. Where does leprosy, a disease dependent as much, probably, as any other on deficient and unwholesome diet, most prevail ? In countries where pork is almost unknown. What is at present the most popular diet and remedy for tuberculous consumption, the most highly developed of scrofulous conditions ? Fat pork for a repast, and cod-liver oil for a desert. Do not understand me as repudiating beef, mutton, game, fowl, and fish, in the above remarks. I consider them all good, and the Chester Whites as A No. 1, on the list. The causes of disease are at the present day multitudinous, and when we speak intelligently of them, we shall have more to say of the manner, than of the matter of diet."

Meat-eating.

Mr. E. F. Garrigues, Hopewell Academy, Mo., goes a step beyond the anti-pork-eaters. He says : "Nothing but the plea of necessity can be used in extenuation of the cruel, selfish, barbarous and disgusting practice of butchering innocent animals God has created to occupy and adorn the earth, to satisfy an inordinate appetite. The better feelings of our better nature revolt at it. When a man has no choice, let him eat such as he can get. But when he has the power to choose, let him eat the best. I can live cheaper and better on vegetable than animal food. Bread is the most important of all. The potato is king of vegetables, as the apple is among fruits. With bread, vegetables, and fruit, in all their endless varieties, and plenty of good milk, butter, and cream, I can live very comfortably."

Mr. R. G. Pardee.—My youth was spent among pork-eating New Englanders, where scrofula was seldom if ever heard of.

Mr. Wm. R. Prince, however, contended that it was very common at the west, where pork is the principal food, and that no other food was so deleterious.

Concrete for Foundation Walls.

Mr. Washington Smith, Lamont, Ottawa Co., Mich., writes: "As we have no stone, we need something for foundation. I saw your recommendation to a man similarly situated, to make his foundation of concrete. I must confess my ignorance by asking you how such a wall is made?"

Mr. Solon Robinson.—If you have no stone, use the coarsest gravel you can obtain, with which fill a box either in sections or large enough to make the whole foundation wall of one side of your building. Now mix lime, one part; coarse sand, two parts; with water enough to make the mixture run freely. Pour this into your box of gravel or broken stone until all the interstices are filled. In a few days you may remove the box, leaving a solid block of stone. This is concrete. The same process repeated, layer after layer, makes the concrete walls of a house, sometimes three stories high.

Farm Buildings.

Mr. S. J. Willson, Ripley, Chautauqua Co., N. Y., has a new plan for making a house cheap, durable and warm, which looks as though it would succeed admirably. "Whitewood boards for siding are worth here $20 to $22 per M. Suppose, instead of planing and lapping them as usual, I put them on so as to make a smooth surface, and cover that with roofing and plastic slate?"

Mr. D. S. Wykoff, Hopewell, Ontario Co., N. Y., asks: "The roofs to my barns are leaking badly; can I put this wonderful cement on top of my old shingles, or must they be pulled off first?"

Mr. Solon Robinson.—To make a perfect roof, the old shingles must be entirely removed and the boards covered with felting, upon which the mastic is laid. You may stop the leaks of the old shingles with this mastic easier than by any other method you can adopt.

Tree-planting on the Prairie.

Mr. Samuel Edwards, Lamville, Ill., urges everybody to plant trees. He says: "The day is not far distant when all the timber in the prairie region will be needed at very high figures. For screens, evergreens are the best—they can be had of nurserymen

at all prices, from $2 or $3 per 100 and upward. It is safe to say, that $20, judiciously invested in them, will, with proper care for ten years, add $200 to the selling value of any prairie farm, and more than twice that amount to its comfort and beauty as a home. At the present rate of devastation, in twenty years more the native groves in this vicinity will be gone. Plant trees—the birds in crowds will come to aid you, by destroying multitudes of insect enemies, and cheer you with the sweetest and cheapest of music. Plant them for yourselves and your friends to enjoy while you live, and as a lasting blessing to your children. The greatest need we have for timber is not, as some have supposed, to cut down for use, but for shelter—protection from the bleak winds of winter. During the terrible western 'wind storms' of winter, which drive all animals to shelter, or chill them to death, men work under the lee of these belts of evergreens as comfortably as if protected by a stone wall."

Adjourned.

April 24, 1866.

Mr. Nathan C. Ely in the Chair; John W. Chambers, Secretary.

Pyrenean Spinach.

Mr. Wm. R. Prince, Flushing, L. I., sends to the club for distribution a quantity of the Pyrenean spinach, and gives the following information in relation to its cultivation:

"The Pyrenean spinach is an Alpine plant, capable of enduring the severest cold of the most northern States of our Union. It is perennial, and therefore, if grown in good soil, will endure for a long course of years. The seeds may be sown in the same manner as cabbage seeds, and when about the same age as they are usually transplanted, say four or five weeks old; these may be transplanted in like manner into beds, which for convenience had better be of about four feet in breadth by ten feet in length, and the plants should be set therein at a distance of ten inches in each direction. Beds of these dimensions should comprise four rows of plants and eleven plants in each row, allowing for breeders. One such bed would afford spring greens for a small family, and two beds for a large one. The foliage of this plant resembles our dock, but is thin and delicate, and of very pleasant flavor. The precocity of the plant is such, resulting from its Alpine character, that the

snow and frosts will have but just left the soil, when its foliage will start forth, and furnish at once a pleasant and beautiful vegetable for the table, and it may be hailed as the first vernal production which nature, in her beneficence, presents for the healthful recuperation of the human system from the seemingly adverse conditions which the seclusion of winter and the deprivation of fresh garden products have entailed upon it. I am not aware that this plant exists in any family garden of our country except my own, and esteeming it as of great value in the family economy, I have taken some pains in its dissemination throughout our country the present spring, and have distributed several hundred parcels of the seeds through the American Institute and otherwise."

Dr. Snodgrass said, that "we were not fully aware of the value of that kind of spinach. Our systems need the acid afforded by such a plant. The whole family of greens will regulate our physical system and give tone to our health. A small quantity of vinegar taken in connection with the greens will improve its efficacy as an article of healthful food. Those persons who are cut off from the country and confined within the city limits, should secure such articles of food to promote their health."

Col. Henry spoke of a plant known as "patient's dock," as one of the best he ever used for greens. It has this name because it may be eaten by persons in delicate health, not only with impunity, but advantage.

When to cut Timothy Hay.

Mr. G. H. McKinney, Stanford, Lincoln Co., Ky., makes this inquiry and the following statement: "At what particular time should timothy grass be cut for hay, and is there any sure indication that it is ready, and when cut how long should it remain exposed to the hot sun to cure, in order to retain a bright green color?

"This is a question about which many of our Kentucky farmers hold different opinions, some maintaining the position to cut when the bloom is nearly ready to fall off, while others prefer to wait until the grass is fully ripe."

An intelligent farmer near Albany, N. Y., who grows hay upon a large scale for market, gives the following rule for a proper time when to cut timothy: "Whenever in the blooming stage it had grown and obtained sufficient strength to pull up by the root without breaking the straw, that it was then ready, and, if cut at

this particular stage, it retained its color and never turned black at the joints; but if cut previous to this stage, the latter would be the case, with loss of weight; and that if cut at the time indicated by him, you would have much more hay in weight, a matter of great moment to those cultivating it on a large scale."

Mr. Solon Robinson.—It is not Kentucky farmers alone who maintain these various opinions. They prevail all over the United States. I do not recollect, during the quarter of a century of my residence at the west, ever seeing a field of timothy cut until a portion at least the seed had become ripe enough to grow. It was then contended as a necessity for preventing the field running out; the scattered seed constantly renewing the plants. I have frequently heard farmers there assert that three mowings of green timothy would kill it dead. Many farmers made it a point to let the grass stand until nearly all of the seed was ripe, so they could save it upon the barn-floor while foddering out the hay. A great many also contended that the ripe seed was worth more for cattle, and particularly for horses, than hay made of the grass cut green. They also contended that the straw was no more injured for fodder by ripening its grain than was the straw of oats or wheat. It is very certain that timothy left to stand until it is ripe may be cured for hay at much less expense than when cut green. My own practice was to sow it twice as thick as was there usual, putting a peck or more seed to the acre, which made the straw grow fine; and I then let it stand until the lower half of the heads were generally ripe, and some of the most forward ones entirely so. It was then easily cured, and I thought made good hay, and gave me all the seed required for future use, by saving the scattered chaff every morning where the hay was thrown from the mow.

It is perhaps equally important that we should discuss the proper time for cutting other varieties of grass and clover. We hope, before it is time to cut either, we may have the opinions of a number of practical farmers upon this subject.

Col. Henry said the reason why Long Island farmers cut their timothy in bloom is because the hay suits city purchasers. For his part, from careful observation, he believed such hay is not worth as much by fifty per cent. as it is when made from grass which has reached a more mature state. It is with timothy much as it is with sorgo cane, if that is too immature it will not make sugar, and but poor molasses. Such grass is sappy, the hay is much less nutritive, does not contain the flesh-making qualities

that it does after the seed is ripe enough to vegetate. One man of his acquaintance made a practical test better than any analysis by feeding the hay cut at different stages to his animals. He also tested by weight and found that a given space would yield twenty per cent. more dry hay if the grass was cut when mature than it would when cut green.

Mr. George Bartlett said he has had some notions about allowing grass to ripen before it is cut. He thought it would be an excellent plan if the agricultural societies would offer a liberal premium for the best well-conducted experiment in cutting grass, for hay, at various stages of the growth of the grass. Such an experiment, if properly conducted, would enhance the value of the hay crop very largely.

Mr. Adrian Bergen gave the reason why farmers in his neighborhood cut timothy green; it looks handsomer when offered for sale. He has tried both ways, and is in favor of letting it stand for his own use until a portion of the seed is ripe. He can then cure it and house it the same day. His rule is, when his grass begins to turn brown at bottom to begin to cut; then his stock eat it well and thrive better than when it is cut green.

Dr. Snodgrass said that it was the universal rule in the Shenandoah Valley to cut the wheat before the hay. All farmers in that section prefer to have their timothy somewhat mature.

Mr. John P. Veeder, Albany Co.—There is no question upon which the opinions of farmers are more varied than the proper time to cut timothy. As a general rule, in my section, it is cut pretty green; it is mostly harvested before the rye. Farmers generally think it best cut early. Some, however prefer to have part of the seed ripe enough to grow. It is then much easier cured, and not liable to mow burn. The less it is spread after mowing the better. If the weather is favorable, it may lie in the swath one night, or be put up in small cocks and remain longer before it is carted. It should never be cut when the dew is on; and, in my opinion, the tighter the barn the better.

Mr. S. Edwards Todd.—We have had a sufficient number of experiments among good farmers to establish the point under discussion, that if grass be cut when in full bloom the hay will weigh more and afford more nourishment than if allowed to stand till it is fully ripe. Hay made of ripe grass will go further than if made of green grass; yet the same hay would have furnished more nourishment had it been cut before the grass was fully ripe.

Barometers as Weather Guides.

Mr. Charles Wilder, Peterboro, N. H., stated that he is a manufacturer of barometers, and he desired an expression from the Club in regard to the practical utility of these instruments for common farmers. He said his agents stated that the Farmers' Club of New York had denounced the use of a barometer on a farm, and they found the influence of such an expression exceedingly detrimental to their interests. He desired Mr. Solon Robinson to give his views as to its practical value for common farmers.

Mr. Solon Robinson said that as his remarks had been called in question, he would now state it as his firm, honest belief that a barometer was of no possible, practical utility to a farmer. It will sometimes indicate the approach of wind, and sometimes they may be accompanied by rain. When he commenced his observations he was a firm believer in the value of the barometer, a belief gained without knowledge from the reading of the statements of others, that by observing certain rules one could always foretell the approach of storms. These rules are utterly fallacious as laid down in all scientific works, and copied upon the cards and advertisements of barometer makers. One of the best letters ever read before this Club upon the use of barometers was by an old Quaker farmer in Salem Co., N. J. He was able to rely on his barometer, but did it by going just contrary to all printed directions and scientific theories. I have published the experience of dozens who have tried barometers and found they could not rely on them, I did believe that we should find practical value in them, but I frankly say now I do not believe they are worth one cent. When they sink lowest, indicating certain rain, there is just as likely to be nothing but wind. I believe the favorable reports have come from observing one case in which the barometer happened to be right, and overlooking a hundred others when it was wrong.

Mr. Adrian Bergen, an old Long Island farmer, said he did not believe in barometers. His experience had taught him to place no reliance on them as weather guides.

The chairman said it had been stated at a former meeting of the Club, that a minister, having a barometer, caused the church bell to be rung, when his barometer indicated a storm, so that all his parishioners might prepare in time for the shower; and those who heeded the bell secured their grain and hay, while unbelievers suffered loss from the storm.

Mr. S. Edwards Todd said he had been familiar with barometers, more or less, for the last fifteen years, and had been intimately acquainted with several other excellent and intelligent farmers, who had watched their barometers from early dawn till evening, and all of us, without a single exception, have been obliged to acknowledge that barometers are really of no practical value to common farmers in securing their crops from the coming storms. He said he once met with an old sea-captain, who stated that a good barometer will indicate the approach of a high wind at sea, but not a storm, with any degree of certainty. He had seen the names of publishers, where they have appeared more than one million times, appended to statements attesting to the *cash* value of a single barometer to them. He would not impugn the veracity of such men; yet he felt pained to see so many honest and industrious farmers bamboozled, hoodwinked and gulled out of their hard earnings by men who profess better things, and who know better than to palm off such worthless instruments, at extortionate prices, on honest men, when they themselves know that such things can be of no practical utility to common farmers. There may be some good barometers; yet, an ounce vial with its neck cut off with a string, and filled with water and suspended from the wall bottom upward, is worth more than all the barometers that can be stored in this room for indicating the approach of a storm. No barometer that I have ever seen would indicate, with any degree of certainty, whether the clouds would pour down torrents, or only a gentle sprinkle of rain. These things are hard for our friend with barometers. Yet as we are sworn attorneys for the interests of industrious and hard-working farmers, they must come out, without fear, favor or compromise. If we can be convinced that barometers will enable common farmers to regulate their field operations so as to escape damage from storms, the world shall have the benefit of the experience.

Mr. Wilder.--One reason why the printed directions so often fail, is that they have very generally been taken from English books, which calculate for a climate entirely different from ours. Mr. Robinson has confessed to me that all his own observations have been with an aneroid barometer, which no scientific authority esteems reliable. I wish he would take a good mercurial barometer, observe it six months, and report.

Mr. Bartlett.--Such observations can be found for different

parts of the country in the Smithsonian reports, from which any one can make up a table.

Mr. Wilder.—Such a table has for several months appeared in the *Agriculturalist.*

Mr. Solon Robinson—I would sooner trust the test to a plain, practical farmer. Let us call for information from farmers, and see how many report getting prophecies from their barometers soon enough to be of any use.

Col. Henry remarked that no vessel would be allowed to go to sea without a barometer.

Mr. S. Edwards Todd.—Last summer, in Connecticut, I visited a farmer who had paid a great price for a barometer, on the recommendation of a certain New York publisher. He had studied it two years, and told me he did not think it worth one cent in practical farming. At the same place I conversed with an old sea captain, who said barometers would foretell wind at sea, but were no indicators of rain.

Monroe's Rotary Harrow.

A model of Monroe's rotary harrow, made by H. H. Monroe, Rockland, Maine, was next exhibited. The harrow is circular, and is drawn by a shaft pivoted at the centre. A weighted roller depresses one side and keeps the harrow in constant rotation. It is much more thorough in its work than an ordinary harrow, can be used among stones and stumps, and will not clog among corn stubble. At the last New York State Fair it was awarded a silver medal.

Sirup from Indian Corn.

Mr. George Bartlett.—Something has been said here, and a good deal written and talked all over the country, about the purchase by sugar manufacturers in this city of a newly discovered process of making sugar out of Indian corn. Then we heard that the sugar part had been abandoned, and the parties were manufacturing sirup which would rival sorgo, and use up the great staple crop of Illinois. I have lately ascertained that this process has been entirely abandoned, and the manufacturers have come back to the old and well known one of converting starch into sirup, which can only be done to advantage near where the corn is grown, where there is good water privilege and large starch manufactories in connection with establishments for converting it into sirup.

Preserving Fruits.

Mr. Solon Robinson.—I understand that Messrs. Taylor, Croxon & Co., Trenton, N. J., have erected one of Prof. Nyce's Fruit Preserving Houses, capable of holding eight thousand bushels of fruit.

Prof. J. C. Booth, Philadelphia, speaking of this method of preserving fruit, says: "The mode of construction and the simple materials used, appear to me to attain all the objects required, as far as we know them, in the most perfect manner. The question of economy is easily settled by the moderate cost of construction, and the extreme cheapness of ice and the chlorides. The dryness of the compartments, secured by the use of chlorides of calcium and magnesium, obtained at a trifling cost from the waste bittern of salt works, seems to be as perfect as desirable, and its degree is ingeniously measured by a balance weight of the same salts, visible through glass from the hall, in each compartment. The necessary cold (thirty-four deg. Fahrenheit), is of course maintained by the complete covering of the ice above, which, being charged in one winter, lasts until the next, with a surplus to spare. Such coldness, dryness, and an exclusion of light and air, must certainly tend to preserve the fruit as perfectly as any mode that can be devised.

Prof. Silliman says: "I cannot see what remains to be desired in the perfectness of your plan. Every considerable city should have such a fruit house in its neighborhood, as a means of health and enjoyment to thousands, who would thus be provided with delicious and healthful fruit."

Parties in this vicinity may find it profitable as well as convenient to visit this fruit preservatory at Trenton. It is a shame that we have not a dozen like it in New York.

Concrete Houses.

Mr. Charles Williams, Vineland, N. J., exhibited an improvement in the construction of concrete houses, which is about being patented. It consists in putting up first a wooden frame, of stuff one inch by two inches, and building the concrete about this in the usual manner. The frame prevents danger of crushing or cracking; poorer materials can be used in the wall, and the wall can be much thinner than in the old way. In answer to questions, he gave the best formula for concrete mortar, as sand and gravel, with 1-10 to 1-9 lime. It is not best to make it into brick first, as such walls are more likely to crack.

Club-foot Cabbage—Remedy.

Mr. David H. Holden, Poughkeepsie, N. Y., gives the following remedy for club-foot cabbage, from a successful grower: "Unleached ashes, used plentifully on the seed-bed, and a handful in the hill, is a sure remedy. The party giving the information says he has raised cabbage twenty years on the same ground, and never has any club-footed."

Mr. Solon Robinson.—We presume there are plenty of other persons who have raised cabbage upon the same ground twice that length of time who never used ashes, and who never had any club-footed cabbage. Therefore, "who knows" whether ashes are a remedy or not? It is pretty certain that in some soils or situations the disease is not known, or, if known, is not troublesome.

Adjourned.

May 1, 1866.

Prof. S. D. Tillman, in the chair; John W. Chambers, Secretary.

Bituminous Slate.

Mr. Solon Robinson exhibited specimens of a new kind of fuel from Lafayette county, Wis. It has the appearance of ordinary clay slate, but burns with greater readiness than bituminous coal, emitting a black smoke and a kerosene odor. Mr. Robinson said the sand rock in many parts of the oil region will burn in the same way.

Wood Coated with Coal Tar for Drains.

Mr. J. K. Parrot, Cincinnati, Ohio, says that he is about to put down a drain of three-inch boards nailed together in a V shape, and, for preservation, designed to coat them with coal tar, and then sink them to the depth of three and a half feet below the surface of the ground. He wishes to ask the club if the gaseous evaporation of the coal tar rising up through the ground will injure vegetation above? His attention had been called to the poisonous nature of this gas by the fact that upon the recent laying of gas pipes in his town, the little leakage that at first occurred at the joints instantly killed the shade trees whose roots came in contact with it.

Mr. S. Edward Todd said that at the depth of three and a half

feet there could be no danger of injuring vegetation, though the gas is undoubtedly very poisonous.

Smith's Farm Gate.

Mr. C. T. Smith, Nyack, N. Y., exhibited a new farm gate, so arranged that it does not sag upon the post, and with a latch so contrived that the gate may swing back and forth without jarring against the post, as it only latches when the gate swings slowly. There is a center post between two small gates which has a hinge upon one side and a clasp upon the other, by which the gateway is used for a small gate or a wagon-way, by simply unhooking the post so that it will lie down. There is no patent upon the improvement.

Goitre in Lambs.

Mr. Solon Robinson read a letter from Mr. J. C. Frazer, giving kerosene oil as a cure for this disease. Care must be used not to apply so much as to produce soreness.

Warts on Cows' Teats.

Mr. N. W. Clapp, of Montgomery, Vt., wants a remedy for warts on cows' teats.

Mr. N. C. Meeker.—Salt has sometimes succeeded with him.

Dr. Snodgrass.—They can be removed with almost any of the acids. Nitrate of silver is perhaps the best remedy if it can be readily obtained. If not use sulphuric acid, or muriatic, or even Java water. Weaken the acid so that the finger will bear it, and two or three applications will kill the wart. In a little time it will slough out and the teat will heal over.

Blue Jay.

Mr. C. H. Murray, Cincinnati, Ohio, says: I wish to call the attention of the farmers generally to the great importance of making unceasing war upon the bird known through America as the "jay" or "blue jay." The true character of this bird is not generally well known. A more destructive marauder, a more cunning sneak and thief does not exist than he. When I was a boy, my father, who was a great admirer and protector of birds, rewarded myself and brother with a royalty of two cents per head for all the jays that we should destroy. And many were the villians that fell beneath our avenging guns, until we nearly rid the neighborhood of the pests. The jay is the worst and most

dire enemy of all the small feathered tribe. A jay will destroy more birds in one season than a hundred cats. Not only will they search every nook and cranny for birds nests and devour the young in them, even when they are three or four weeks old, but they will suck the eggs, and sometimes maliciously tear the nests apart. A hawk or a kite never prey, except when they are hungry; but the jay never allows an opportunity to pass to bring ruin upon his smaller feathered neighbors. I know the habits of the bird well, and have watched them in their mischief a hundred times. He is something of a coward too, and would sooner pillage the nest of a little chippy or wren than that of a red-bird or robbin. When they are hunting a nest, or go to rob one, they are very quiet and sly, but after eating a bird or two, or sucking three or four eggs, they fly off to some neighboring tree and cry out "reconstructed," "reconstructed," with as much impudence and conceit as some of the recent murderers of the South. Therefore, if any of the farmers' boys want to try their fowling pieces, or shoot out an old load, let them always direct it towards a jay, with the gratification of knowing that if they bring it down, they are doing the world a great service.

The Chairman objected to their destruction on account of their beauty.

Mr. S. Edward Todd remarked that he had never heard the blue-jay charged with the crimes alleged against him by Mr. Murray. There was such a diversity of opinion upon the subject that he should like to have the opinion of practical farmers, who can say: "I know."

Washing Sheep.

Mr. C. S. Osgood, Bothwell, C. W., sends a lengthy argument in favor of washing sheep, of which we give a portion, embracing the leading points, because we have published a good deal in opposition to the practice of washing, mainly on account of its direct tendency to encourage fraud. Mr. O. says: "All that should be attempted in washing sheep is to fairly clean the wool of this old, offensive sticky gum that has been a year accumulating, and not sozzle the poor animal in cold water half a day in the vain attempt to wash out all the traces of smut, hayseed, burdocks and the like, and to soak out tag locks that should be sheared off and lie in a tub of water a week before attempting to wash them. All this may be much better left till the wool is off

the sheep. But, as to shearing sheep without washing all, I regard it as a nasty, disagreeable job, only to be submitted to in a case of necessity. And as to time and comfort, both, I would sooner wash two sheep and shear one of them than shear one without washing, as, beside the nastiness of the job, the shears enter and run in the sticky gummy wool very badly, and are continually becoming dull with the dirt. So, all that is saved by not washing goes over the left. As I regard it, the proper course is to give the sheep a smart, hasty wash, paying little attention to anything but discharging this old gum. Then let the sheep run in a clear place where there is no sand for them to lie on, from a week to a fortnight before shearing, which gives time for nature to give a fresh supply of "oil," as it is called, which is neither so abundant, or dirty, or gummy as the old that has been washed away. And manufacturers tell me they much prefer to buy wool treated in this way to that that has been washed, although the latter is much the cleaner. But they say that oil or grease will not make wool work nearly as well as its own natural lubrication. The gum of wool is soluble in water—it is more like soap than grease. Five minutes is long enough to keep a sheep in the water."

Mr. Solon Robinson took ground against washing at all; first, because it injures the sheep and the appearance of the wool, and second, because the true weight of the fleece cannot be so well determined.

As a cure for lice on cattle, it was recommended by letter to feed saltpetre, a teaspoonful to the creature each day for three days.

Dr. Ward stated, in reply to this recommendation, that the remedy could not be effective, inasmuch as saltpetre expends its whole force on the kidneys, and does not work out upon the skin at all.

To Cure Garget.

The writer of another letter read, asked for a remedy for the garget in cows' udders. Ans. Feed the cow garget root mixed with grain, and wash the udder with the steepings of the same. If the dugs are badly affected, wedge small-pointed slips of the root into them. It is believed that this will prove an infallible remedy in all such cases.

To Destroy Films on the Eyes of Animals.

In answer to a letter asking for information on this subject, Solon Robinson said that pulverized white sugar, blown into the eye, and allowed to dissolve there, will generally effect the removal of the flim. Very finely pulverized glass has also been recommended. The former, however, is believed to be much the more safe and effective.

Goitre.

Mr. O. R. Howes, of Wyoming, N. Y., in a letter to the club, stated that a number of his this year's lambs are afflicted with a swelling or hard lump in the throat, near the windpipe. He wished the club to give the name of the disease, and prescribe a remedy.

Mr. N. C. Meeker.—The disease is one that has been frequently brought before the club, and is treated of in all books on sheep husbandry, especially in Randal's "Practical Shepherd." It is called "goitre." The application of kerosene oil is recommended if not applied too freely. (See the "Practical Shepherd" for further information.

Grafting with Buds instead of Cions.

The Chairman presented specimens of bud-grafting from J. L. Smith, Washington City, who says he has practiced it with success for 20 years. He detaches a fruit bud, makes a slit in the bark of the stock and inserts it.

Mr. P. T. Quinn said he had practiced that method of grafting, but finds it objectionable, because it does not produce sufficient wood, although it does give fruit sooner.

Dr. Isaac M. Ward said the plan was no advance upon the oldest accounts of grafting. He has seen a stock four inches in diameter cut off square and buds inserted all around. The process is easy, but it is not an improvement upon cleft-grafting.

Seed Corn.

The Secretary reports the receipt of half a bushel of sweet corn from J. E. Brownell, Scottsburg, Livingston county, N. Y., and that he is sending off the mass of envelopes on hand, with this and other seeds as fast as possible.

Planting Seeds.

Mr. Wm. R. Prince presents the following directions for planting seeds:

1st. As a general rule select a light, permeable soil, and let it be well mellow.

2d. As a rule seeds should be sown thinly, so as to give each plant ample room for growth and expansion, as many species require 12 inches square for development, and especially all shrubs and perennial plants.

3d. Cover the seeds with their own diameter of earth, in accordance with which the smaller seeds are only to be dusted over.

4th. Water them with a rose watering-pot immediately after planting, and repeat this daily toward evening until well advanced in growth.

Cattle Feed.

Mr. M. V. B. Hathaway, Calais, Vt.: "What is the comparative value as feed for stock of turnips, carrots, beets and potatoes? What varieties of turnips and beets are most valuable for this purpose?"

It is difficult to give the exact comparative value. Carrots generally rank first, and we should put potatoes before beets, and turnips last, though many believe that rutabagas are equal to any of the other roots. Sugar-beets, or mangel-wurtzel, are the best beets.

This question called up a good deal of discussion among members, and several of them who had had considerable experience in the matter gave their opinion in favor of parsneps for milch cows over any other root, not only as the most profitable crop to grow, but as producing the best results.

Mr. Fitch, Elwood, N. J., related several anecdotes showing marked results from feeding baked potatoes. He had fed them to a horse, and found them not only the cheapest but best food he ever used. He also recommended very highly the use of sawdust for bedding. For sweet potatoes he never had found any manure as good as this.

To Stop Runaway Horses.

Mr. H. M. Deming, Auburn, Kansas: "My observations has led me to conclude that there are many more runaways happen from frightened drivers than frightened horses. To stop a running horse gather up your reins and give one of them a strong pull and let up quickly, then in a moment pull again on the same one or

the other, whichever will be apt to turn him into clear space, letting up suddenly every time. The pull must be one calculated to throw his body sideways, and not a sudden jerk, and don't pull but one rein at a time. It will be simply impossible for the horse to run. He will have to stop and hunt up his center of gravity or fall down, and then he will surely be stopped."

Paint for Outside Work.

Mr. M. V. B. Hathaway, Calais, Vt., inquires: "What is the best paint for outside use, with regard to economy, durability, and appearance for dwellings? What is the comparative value of white lead and white zinc as a paint for outside purposes?" We answer lead, undoubtedly; but not what is usually, or at least commonly, sold for "white lead, ground in oil." An analysis of what purported to be such paint has lately been made by a chemist in this city, showing the following results: Sulphate of barytes, 81.52 per cent; oxyde zinc, 7.28 per cent; oil, 11.20 per cent. It will be seen that there was not a particle of lead in the composition, and that as a paint it must be nearly worthless. A pure article of ground white lead brings 16c. from manufacturers' hands, while this stuff was sold at 7½c. per pound, and at a great profit at that. Such whiting is no better than white clay or lime; it will dry and rub off as powder; while lead hardens into a thin metallic coat, which covers and protects the wood.

Prof. Tillman said the great objection to the sulphate of barytes, which is sometimes called heavy spar, is that it does not possess body enough to make the paint durable. It is as heavy and as white as lead, and the adulteration is hard to detect until after it has been used as a paint, and then it is too late. Silicate of magnesia or white soapstone is often used to adulterate both lead and zinc. If we could have zinc pure, it is undoubtedly best for all inside work, as it is whiter, in the first instance, and does not change color, and is not poisonous to those who use it.

Sorgo Planting.

Silliman, Bowman & Co., Brockport, N. Y.: "The proper season for planting is as early as the ground gets in good working order, and no danger apprehended from frost. One and one-half pounds of seed is considered sufficient for an acre, with a margin for thinning. Most cultivators prefer soaking the seed in warm

water before planting, and not covering more than one-half to three-fourths of an inch deep with earth; while others advise planting dry. Of course, to plant soaked seed, the top of the ground should be moist, and the earth packed nicely on the seed. Care should be taken not to plant contiguous to broom corn, as the corn and cane will hybridize. Four by two and one-half feet is a good distance to plant; that allows cultivation both ways; leave ten stalks in a hill. A dry, sandy, gravelly loam, moderately rich, is considered preferable for the highest development of the saccharine qualities of the cane. Do not manure heavily with fresh manure. The soil should be plowed quite deep, and very thoroughly."

Barometers for Farmers.

Prof. Tillman.—While I coincide entirely with the remarks of Mr. Robinson last week—that an ordinary barometer is entirely useless for a farmer, particularly if he endeavors to follow the printed rules—yet I am happy to state that a new instrument has been constructed by Prof. Hough, of Albany, by which the changes of weather can be indicated with a degree of certainty. The instrument is so connected with an electrical machine that both are operated together, and so accurate and delicate is the machine that it will record the thousandth part of an inch in the rise or fall of the mercury; and 1,200 changes in 24 hours by the pencil, which is operated by the machinery. It has also been ascertained that it is not the rise nor fall of the barometer that indicates an approaching storm, but it is what may be termed a fluttering of the column of mercury in such minute waves as to be imperceptible to the eye. By careful observation of this peculiar property, the Professor thinks storms may be accurately predicted.

Mr. Solon Robinson.—There is one difficulty in the way of this instrument coming into use, that is the cost; the manufacturer at present charging about $250. It is to be hoped, however, that the time will soon come when farmers will be able to avail themselves of this important discovery.

Manures—Salt, Ashes, Lime.

Mr. C. H. Boyd, Niagara County, N. Y.: "Will the Club tell me how to use concentrated manures upon vines—watermelons, for instance. Shall I apply in the hill or upon the surface?"

Mr. Solon Robinson.—Either will answer. If guano is used,

care should be taken not to have it come in contact with seeds or plants.

Mr. D. J. B. Hoyt, Gaines, Orleans County, N. Y. : "How much salt to the acre to kill quack grass? Will salt enough to kill grass and weeds, injure fruit trees? I have twenty-two acres of orcharding apples, peaches, pears and plums, 160 trees to the acre, ten years old, and the entire surface soil has become literally filled with the roots of the trees. I desire to keep the ground friable and free from weeds and grass, if possible, without plowing. Will the Club allow me and the public in general the benefit of what experience and observation have determined in relation to the use of salt in such or similar cases."

Mr. Solon Robinson.—We doubt whether salt can be used in sufficient quantities without injuring the trees. Ten bushels of salt to the acre would be beneficial to them. It would make the ground more friable, but would not kill quack grass.

Mr. P. T. Quinn said he had some experience with salt and was satisfied that any quantity that would kill weeds or grass would also kill trees. He would not apply over eight bushels per acre, and that quantity, he thought, would be beneficial to any orchard.

Mr. William Hill, Flemington : "We find ashes here on heavy clay land an excellent application both for grass and wheat. Price paid by farmers from 25 to 30 cents per bushel."

Mr. Solon Robinson.—Wood ashes burnt in a brick kiln, if they are kept clean and not exposed to the wet, are more valuable than any burnt in a stove; and ashes exposed to as great heat and thus reduced in quantity, in a kiln for burning pottery ware, have been much sought after here for use on land, and for making lye for soap, at 5c. per bushel, more than ashes made from same kinds of wood in stoves.

Apricots are Hardy.

Mr. H. B. Smith stated that apricots at Westfield, Mass., have proved hardier than peaches. The buds this year are entirely sound, while those of peaches are all killed.

Moving Apple Trees.

Mr. Wm. Cluley, Leadsville P. O., Monmouth Co., N. J. : "I have a few apple trees, probably ten years old, that I wish to move. Can it be done safely, and at what season?"

Mr. Solon Robinson.—We would move them in the winter. Dig around in autumn so as to freeze a ball of earth to the roots, and

hoist that by a properly arranged apparatus, attached to a wagon, carrying the tree to its place and dropping it in a hole previously prepared.

Experiment in Growing Apples.

Mr. Allen Wilson, Spencer, Owen co., Indiana, cut a graft from a Siberian crab tree, six years old, which had never borne fruit, and set it in a thrifty apple stock. The graft grew three feet in the summer of 1863, and was accidentally broken off about ten inches above the junction. In 1864, it threw out several sprouts, which were pegged down after the manner lately recommended for peach trees. These branches grew vigorously, and bloomed and bore fruit in 1865, at the same time the original tree first bore fruit. The query is: Did the treatment the graft received hasten the time of fruiting? If so, others can practice it.

A New Implement for Corn Planters.

Mr. J. A. Burchard, Beloit, Wis., who says he is a practical farmer, and has always found the hoe the safest implement with which to put seeds in the ground, has invented a little machine which is attached to the handle, out of which he can drop any kind of seeds by merely touching a little spring to the ground which projects just beyond the blade of the hoe. If it does not add too much weight to the hoe, it will be a useful instrument.

Information for Emigrants.

Mr. O. L. Abbott, Bethany, Harrison county, Mo., wishes to call the attention of emigrants to that section: "Harrison county is geologically situated in the upper part of the coal formation, and geographically located in the northwestern part of free Missouri." Surface is gently rolling; no swamps; climate mild and healthy. Land well divided in timber and prairie; yields 40 to 60 bushels to the acre. All kinds of fruit, except peaches, do well, and many kinds, such as plums and grapes, grow wild in great abundance. Good farms, well fenced, with houses, stables, young orchards, &c., are selling at from \$8 to \$12 per acre as fast as disfranchised rebels can find loyal purchasers; uncultivated prairie, \$3 to \$5 per acre; woodland, \$10. The people are mostly loyal, and very radical. We have a large school fund, and free schools; and no rum shops are licensed in the county. Persons desiring further information can obtain it without charge by

addressing the writer, with stamped envelope, re-directed, enclosed."

Mr. J. H. Holdsworth writes from Long Branch, Monroe county, Mo., that "timothy and clover grow as well there as at Great Neck, L. I. I cut, last year, 40 tons from 20 acres. Potatoes grow well here; but the old Missourians despise them as a Yankee dish, and prefer to eat corn. From three to five bushels of potatoes is a large crop for most farmers here. This is a good country for farming. The great pull-back is that 19 out of 20 are either rebel or copperhead, and it has been rather a hot place for the Union men the last four years, and the treachery of A. Johnson has not helped us any."

Mr. J. S. Williston, Washington, D. C.—"There is a good opening for farmers on the line of railroad between Washington and Baltimore. I would like to see northern men come in. Land is low, with an upward tendency. Farms can be bought from $20 to $60 per acre; improvements poor. Soil, sandy loam, a good deal of gravel; can be made to raise very heavy crops. Fruit of every kind does well—apples not so well as further North. One man that joins me has put out 20 acres of strawberries this spring."

Adjourned.

May 8, 1866.

Mr. Nathan C. Ely in the chair—John W. Chambers, Secretary.

How to secure a crop of Plums.

Mr. Hugh McConnell, Ontario, Ohio: As the time for looking to fruit trees is around again, will you allow me to give you my experience in plum raising for the last ten or twelve years. The method I recommend has not failed in a single instance. I sprinkle the trees with sulphur once every week, or mix with water and throw it on with a syringe, or some other way, commencing as soon as the plum is shaped, and continue on in the same treatment till the seed is hard. The smell of sulphur in the tree will prevent the insect from injuring the fruit.

Bees.

Mr. D. C. Hunt, of Sturbridge, Vt., gave the following as the result of his experience in bee-keeping during the past year: "On the 20th of March, 1865, I took twenty stocks of bees, all Italian.

The profits derived from sixteen of them was 525 lbs. of box honey; 60 lbs. taken from the hives, nearly as nice as box honey, and twelve new swarms. Cash receipts, $160 for honey, $112 for stocks—total, $272. I began with twenty, and at the end of the year had thirty-six swarms, besides those sold."

Mr. Dodge, of N. J., thought that although such extraordinary profits might, under favorable circumstances, be secured in a section where few bees are kept, yet, if bee-keeping should become anything like universal, it would not pay expenses, from the fact that there is not enough honey to be obtained from the clover and other blossoms in a single neighborhood to sustain more than a few swarms.

Plaster Paris.

Mr. A. Streebe, Fayette county, Pennsylvania, wishes to call the attention of the club to the fact that much of the plaster of Paris offered in the market at the present time is not the genuine article, but an adulteration of ground refuse marble, clam and oyster shells, &c. This mixture is, of course, nearly worthless, and farmers should see to it well that when they purchase they are not deceived by some such adulterated compound.

Rotary Cutting Plow or Earth Pulverizer.

A model of Fithian & Young's celebrated "rotary cutting plow or earth pulverizer," was then exhibited before the club.

By the use of this machine the soil is pulverized by a series of curved knives attached to revolving necks, which are driven by a horse-foot ground motor. The gearing is so arranged that by the horses walking two and one-half miles per hour, over 3,000 of these knives pass through the ground every minute. In fact, the soil is left as though passed through mill stones, and then sifted out over the ground. The motion gives a pure cut and lift, not bearing one ounce on the subsoil. The mixture of manure on any growth that may be on the ground is more complete than could possibly be done by hand. The knives are placed on three movable cylinders, of sixteen inches each, thus enabling the farmer to cut sixteen, thirty-two, or forty-eight inches wide at each passage, according to character of the soil and power of team. The depth to which it stirs the soil is eight inches.

It will thus be seen that the machine does the work of from four to six plows, and obviates the necessity of harrowing. The

present cost is $400 for each machine, with all the necessary appurtenances.

On motion, a committee of five members of the club were appointed to witness a trial of the machine on the Saturday following, consisting of Messrs. Solon Robinson, John M. Crowell, R. H. Williams, John G. Bergen and S. D. Tillman.

Keese's Churn.

The Keese churn was next exhibited by the proprietor, Mr. Henry Brown.

The receptacle for the cream is a tin box, ten inches square. The dasher, which reaches down nearly to the bottom of this box, is made to rotate horizontally by being connected by a belt attached to the crank, which is turned by hand.

Some cream was provided which had been kept on ice during the previous night, and the churn put to a practical test. The butter was brought in five minutes, by watch. The merits claimed for the churn are its cheapness, portability, ease of cleaning, and the rapidity with which it does the work of transforming the cream.

Mr. S. E. Todd said that he had seen a churn that would bring butter in two and one-half minutes, but for all that was not considered profitable, from the fact that it failed to produce the proper amount of butter from a given amount of cream. The question is not how quick the butter can be brought, but how thoroughly. However, all agreed that this churn promised well.

Feed Cutter and Thresher.

Another machine for cutting and threshing fodder was exhibited by the inventor, Mr. Daniel Kauffman, Boiling Springs, Pennsylvania.

The cost of the machine is only $10 more than that of the thresher alone. It is undoubtedly an excellent invention, and was heartily approved by the club. All farmers desiring further information can address Mr. Kauffman. Mr. K. also exhibited a new patent broom. The only part patented is the clamp, which, with the stick, costs seventy-five cents. When the brush is worn out it may easily be replaced by the owner, if he only has the material in proper condition. With a little outlay for broom-corn, one stick and clamp may last for years, and in the end be a great saving of expense.

Upon motion, it was voted that Mr. Reed, now in the city, who professes to be able to illustrate that potato rot is caused by an insect, be allowed to explain his theory before the club at the next meeting, and illustrate it as he may be able.

Mica as a Fertilizer.

Mr. A. Morrill, Orange Co., Vt.: "What is Mica, chemically? The soil of some of these hills twelve hundred feet, probably, above the sea, is a fine loam. Instead of silex *mica* characterized it. Mica is in every stone. Here are schist, granite and limestone boulders, the latter black and tough, but may be broken into building stone. Copper mines not far off, iron pyrites, plumbago, a mixed up region, but mica everywhere. The land produces all the New England crops; but potatoes and Indian (?) wheat, and red-top grass seem to be favorites. Potash is a good special manure, plaster does not pay, bone is needed. Would the club suggest any other special as an antidote to an excess of mica? Orange county is divided in a north and south direction by a fissure (for road and river uses), about 300 feet deep. On one side of this rent stock have bone-ail, on the other there is no complaint, though but three miles away. But on the former the grass and hay are destitute of phosphate. We know the remedy. But if the club could reach the poor cows, through the owners, there would be a song, but not the one the 'cow died on.' Probably not one of you ever saw the poor bovine mother that has given herself away through her udder, has been eaten alive, and in the autumn, the forlorn and emaciated thing, unbraced, all to pieces, skin, but not bones, shrinks before the December winds, but every rough hair utters a complaint and a censure. Sheep and horses do very well."

Prof. Tillman.—Mica is composed of silica, alumina, potash and oxyde of iron. It is one of the constituents of granite. It is generally supposed to add fertility to the soil, on account of the potash it contains; but this alkaline oxyde is not of so much importance as another lime, which is a prominent component of every animal organization.

Mr. Solon Robinson.—Lime is generally found beneficial upon all soils containing mica in excess. The great want of the soil described is phosphate of lime. It would pay richly to spread 400 lbs. of flour of bone upon every well cultivated acre of land in that county.

Blue Jay.

Mr. A. A. Stewart, De Graffe, Ohio, says: I see in a recent report of the proceedings of the Farmers' Club, a letter from C. H. Murray, Cincinnati, O., regarding the destructive habits of the blue jay: and that no member of the Club had ever heard that the jay is a carnivorous bird.

The jay is not carnivorous, but, (like the raven and crow, birds of the same family) is omnivorous; eating fruit, grain, insects or flesh, as he may choose. I have never known him to destroy the nests of other birds, or to molest birds that had left the nest; but the young ones or eggs in the nest are never safe within his reach. He is a sly thief, always stopping his noisy prate when he means mischief. I know no bird or beast of prey, except vagrant boys, half so destructive of birds' eggs and young birds as the jay.

If the jays with which the members of the Club are acquainted are harmless birds, they are entirely different in their habits from our Ohio jays.

Isn't it possible that birds belonging to the same family, may have different habits in different localities?

A Profitable Cow.

Mr. E. A. Russell, Hermitage, Wyoming Co. N. Y.: "Receipts of four months, from November 20, 1865 to March 20 1866:

Butter sold, 147 lbs., 50c		$75 50
Calf raised on the milk (have been offered)		25 00
Butter used in family of six persons, 3½ lbs. per week, 50c.		29 50
Two quarts new milk per day, 6c		14 28
Total		$142 28
Cost of keeping, 1½ tons hay, $8	$12 00	
Twenty bushels roots, 30c	6 00	
Five hundred lbs bran, $1	5 00	
One hundred lbs. cornmeal, $1,50	1 50	
		24 50
Total surplus		$117 78

Plowing.

Mr. Nicholas Shelton, Odessa, Schuyler Co., N. Y.: "Is plowing gravelly loam all the time one way, better than cross plowing?"

No, sir. The more you plow the better your crop. Plow it one way, two ways and three ways, if you can.

The Benefit of Birds.

Mr. D. A. Barker, North Bergen, speaks of the immense number of caterpillars which infested their trees in 1862, not those called tent caterpillars, but the more voracious sort which came afterward. There were so many that they ate most of the leaves off the trees. After they had wound their cocoons, there was one in nearly every leaf that remained. After they had been in their cocoons till their bristles came off, and their wings began to form, we observed a flock of blackbirds busy in the trees, from morning till night. On examining we found they were picking the imps out of the cocoons, and putting them in their crops. Of course we got no apples the next year, but in 1864 I sold $500 worth, from an acre and a half, and sold too early at that, or I should have $600. The trees are full of blossom buds now, but the mercury was down to 30 this morning, April 24, still the little caterpillars are all alive yet, and I guess the fruit buds are. Tell your readers to look for both kinds of worms, and to hope for the blackbirds in June and July.

Dr. E. Parker, Lehman, Luzerne Co., Pa., recommends the use of whale oil soap to keep the worms off the trees. It should be applied with a brush or sponge, in the forks of the limbs where they make their nests. We have no doubt petroleum or gas tar would be equally effective.

Sleeping Rooms—Are Elevated Ones most Healthy?

Mr. Isaac Bond, Washington city: "Are low story rooms equally healthy as lodging rooms with those of upper stories? I have long been led, perhaps more by prejudice, or the opinions of others, than by facts or good reasons, to believe up-stairs decidedly the better; but finding the one-story plans given in Miss Beecher's book, aforesaid, without a hint or misgiving as to their being less healthful, while the sole or chief object of the work, which appears excellent in all other respects, so far as I have read it, is to improve the health of American women, I have been led to question my old opinions, and to inquire whether sleeping on the first floor would do more harm to my whole family of five, than going to the second story about ten times a day would do my wife, who is not very strong, and two very young daughters? If you can furnish facts or sound reasons, bearing upon this question, they will doubtless benefit many others no less than myself. I may

add that economy in building is a very important consideration with me, and I am fully aware that a second story is the cheapest way of getting the same amount of additional room, to what we must have in the first story, two rooms beside woodshed, &c."

Mr. Solon Robinson.—Let us look at a few simple facts, which may, perhaps, upset the writer's prejudice about the unhealthiness of lodging in lower rooms. Nearly all of the ancient farm-houses of New England had one, and frequently three or four beds upon the lower floor. The people in those days certainly were no more unhealthy, than they were after it became fashionable to build two or three story houses. About the cruelest wrong of all that a man of ample grounds can inflict upon his family, is to build a house which compels them often to traverse long flights of stairs I am well satisfied, from personal experience and observation, that a properly constructed one-story house, upon a dry soil, is just as healthy for lodgings upon its lower floor as a higher house would be upon its upper ones. Mr. Bond speaks of the economy of space gained in making two-story houses instead of one. Should the health, comfort and life of the occupants be sacrificed to economy? Beside, it is only economy in the first cost of building material; in all after years it is a serious loss of labor to all the family, who are compelled to ascend to an upper story daily, and frequently hourly, to peform their necessary household duties. An up-stairs sick room is particularly inconvenient. It is bad enough for people who live in cities to suffer from such disadvantages. It is positively wicked for a man building in the country to ape the fashion of city houses. Be assured sir, there is no reason why the lower rooms of a one-story country house should be unhealthy for lodging. Probably one of the main reasons why houses have of late years been built so high, is owing to the expensiveness of roofing materials. That difficulty is likely now to be obviated. Roofing made cheap, durable and safe from danger of fire, will tend to a great improvement in the style of our farm houses. If we discuss the subject enough to awaken the public mind to a sense of its importance, we shall one of these days get back to the comforts of one-story houses.

Mr. R. H. Williams.—I entirely agree with the opinions expressed by Mr. Robinson. I would never recommend building a farm-house over one and a half story high. That is the most economical, as that form will afford all the sleeping rooms necessary to be placed on the upper floor, at a much less cost than they could be

made in a full-storied house, and, beside, it looks more fitting as a farm-house. A two or three-story house is inconsistent with the wants of the farm, and shows bad judgment in those who build them. This is one of the most important questions we have had before the club, and one which affords room for ample discussion. It is sometimes very remarkable to see how one man gives fashion and form to all the dwellings in the vicinity. If some pretentious builder leads off with a high-storied house, no matter how inconvenient, others are very apt to ape the fashion. In one section of this State, the almost universal style is a two-story center, with two one-story wings. The most that can be said of that form is that it is fashionable. Anything that we can say here to improve the style of farm-houses will be beneficial to a great many people.

Mr. John Disturnell contested against lower floor lodging rooms, because he was satisfied they were much more unhealthy than upper ones. He endeavored to prove it from some statistics drawn from Cairo, Egypt.

Mr. Solon Robinson said his position was taken for a dry, hard, rocky soil, like that of New England generally, and not for malarious Egypt.

The chairman said that Judge Butler, formerly a physician at Norwalk, Ct., declares that when people were in the habit of sleeping in lower rooms, maladies prevailed which are now seldom heard of; such as a low grade of fevers. He says prevailing fogs never rise above fourteen feet high, and those sleeping in upper rooms escape its influence. His recommendation to all who build country houses, is to make the cellar under the entire house, cementing the bottom and sides so thoroughly that no gas can arise from the earth, and never to sleep on the lower floor. Beside keeping the cellar clean, care should also be taken to clean the well every year.

Dr. Isaac M. Ward, who lives near the great salt marshes of New Jersey, says, from his house, which is situated on a hill, he can look down upon the banks of fog lying upon a lower level. All our sleeping rooms are upon the upper floors, and, I think, in a more healthy stratum of the atmosphere than they would be if less elevated.

Dr. Snodgrass.—This may be so in that locality, but there are others where the case is reversed. Those living immediately upon the banks of the Potomac, and other Southern rivers, have often escaped malarious diseases, while the houses situated upon the

adjoining hills or bluffs were so sickly some seasons as scarcely to be habitable.

Rev. Henry Ward Beecher.—A few miles south of Indianapolis, upon a high bluff of White river, one of the highest in that locality, in the early settlement of the country, there was a town built. Upon the opposite side of the river there was a small settlement, but slightly elevated, upon the water-level. According to the usual theory about malaria, these houses should have been sickly, and those in the town healthy; the reverse was the fact to such a degree that the town was entirely abandoned, and the houses left to decay and waste. The laws of health are not always to be measured by high or low situations, nor by high or low sleeping-rooms, if they are properly ventilated.

Mr. J. Disturnell remarked.—The miasma rising and floating in the atmosphere, being the noxious exhalations from diseased bodies, or putrifying animal or vegetable substances, exercises a deadly influence according to its density. From well established facts it would appear the pestilential atmosphere possesses a considerable specific gravity. In Cairo and Lower Egypt, where the plague is most fatal, the contagion is not found to ascend so high as the tops of houses; where the Europeans freely appear, and survey in security the havoc of death in the streets below.

The same may be said of Calcutta, in India, situated in the midst of a flat, marshy country, and exposed to tropical heats, can never enjoy a salubrious atmosphere, while cities in the same parallels of latitude, being more elevated, are comparatively healthy.

So in regard to the southern portion of the United States, lying near the level of the sea, disease is found to exist in various forms of fever, while in the elevated portions of the country, where the yellow pine abounds, it is remarkably healthy.

Thus in regard to habitations, it would seem that elevated dwellings or sites, rising above the general surface of the earth, were more healthy than low dwellings or positions subject to an impure atmosphere.

Bone Manure.

Mr. L. L. Abell, Conway, Mass.—"What benefit shall I derive this year from the use of crushed bone upon tobacco or corn?"

Mr. Solon Robinson.—It depends altogether upon the fineness of the article. If you use the Boston Milling Co's flour of bone it will give your crops immediate benefit, because it is in a condition to be at once assimilated. Crushed bone is sold of various degrees

of fineness. The coarsest portion would be of more benefit to a crop four years hence than the present year. In our opinion there is no better nor cheaper manure than bone flour.

Training Peach Trees Low.

D. H. Cole, Memphis, Mich.—"For five years I have succeeded in getting a crop of peaches every year. I plant the trees close together, train the limbs within one foot of the ground, and upon each side of each row, and across the ends, build a board fence eighteen inches high. The space inclosed is sixteen feet wide. In winter the top is covered with boards or slabs, and it might be with poles, and straw or brush. Sometimes I lay the boards over at night, in blossoming time. If you are in a section where the snow falls deep, plant your trees where the drifts form highest. Train your tops in the same way, and in the fall place supports under the limbs, such as chunks of wood, or anything you please, to prevent them from breaking. Peaches can be grown, with a little pains, in any part of the United States."

Garnet Chili Potato.

Rev. Henry Ward Beecher stated that he had experimented with the Garnet Chili potato the last season. He considered this variety an earlier potato than the Dykeman by at least ten days. It is a thorough winter potato, improving as it approaches the spring.

Dr. Ward asked if the gentleman had tried Goodrich's seedling, as this potato has the same characteristics as the Garnet Chili.

Mr. Beecher replied, he had planted some of that variety, and would be able to report next season.

Adjourned.

Kansas and Nebraska.

The following interesting and instructive letter from a member, Dr. J. V. C. Smith, now traveling in Kansas and Nebraska, was read before this club:

To the President of the Farmers' Club:

Dear Sir—While attending the club during the past winter, so many curious facts were presented in illustration of the science of agriculture, that while passing over this magnificent region of Kansas and Nebraska, the thought struck me that it might be quite proper to address you in regard to the actual appearance,

capacity and probable future of this most inviting agricultural section on the continent of America.

A large portion of Kansas is unsurpassed in fertility. It scarcely requires the rudest form of tillage to raise crops of nearly all kinds. With appropriate care and moderate application of labor, however, the capacity of the soil would be immense. Grapes and peaches can be raised to any desired extent. My recollections of the general character of the principal wine regions of Europe, warrant me in predicting that a very large part of Kansas will yet become a vast wine producing country. Lands in Kansas, rich as the most ambitious farmer could desire, can be purchased for from five to twenty-five dollars per acre, in the vicinity of cities, embryonic, to be sure, when compared with those on the Atlantic seaboard, but destined, at no very distant point of time, to become centres of immense activity, population and wealth. Railroads are already coursing in various directions over the beautiful prairies, and will, beyond a doubt, within a few years permeate all the States and territories of the west.

Yesterday I made an excursion into the country, thirty miles from Omaha city, to enjoy the spectacle of the virgin fields of boundless extent which have never been disturbed by the plow or the hoe. In fact a hoe may never be required. A farmer informed me he raised fifty bushels of corn to the acre without ever meddling with the land after the seed had been dropped by a machine. Everything which is required for the support of man or beast is sought at the door of the producer, at good prices. Stock may be raised almost without care. Cattle provide for themselves the year round, as the buffaloes formerly did. All the Missouri steamers are crowded with real or prospective imigrants and traders; the incipient railroad lines are full, and hotels and all other dwellings are made quite uncomfortable by the onward moving mass of humanity. The gold mines beyond are magnets that are attracting vast armies of miners, with their mule teams, in their direction. Besides other inducements for leaving the over-stocked cities and lands of the Atlantic States, coal, iron, lime and, in short, almost every mineral invite the intelligent industry of man. If the Farmers' club would lend its influence, how many impoverished, embarrassed and crippled landholders and laborers of the east might be induced to move hither, and thus infinitely better their condition! Boys and girls from the various benevolent institutions would be a blessing here, and grow up to be men and women under aupices

tenfold better than where they are now entering upon the responsibilities of life. To furnish the means for enabling poor but worthy families to leave the city to settle in the west, would be the highest order of philanthrophy.

A Long-keeping Sweet Apple.

Mr. J. L. Gerrish, Mastyard, N. H., sends a specimen of a medium-sized, yellow, sweet apple, which keeps perfectly, without any extra care, up to the present time, and is of pleasant taste and delicious odor. It is known in that locality as "Center Apple." It is not recognized by any one present.

Tree Hopper.

The cherry twig sent from Seneca county, N. Y., by Mr. L. Yarnell, shows a mark upon one side, several inches in length, which looks as if it had been punctured by the teeth of a fine saw, is the work of an insect, Doctor Trimble says, known as the "tree-hopper." It does not do much damage. Adjourned.

May 15, 1866.

Mr. Nathan C. Ely in the chair—John W. Chambers, Secretary.

Improvement of Potatoes.

Mr. John Owen, Fairmount, Mo., writes to the club thus: "Permit me to make known to you, and through you to the world, a little of my practical knowledge from thirty years' experience in the culture of the Irish potato. To improve their quality, perfect the species, increase the size, and make it mature in the shortest possible space of time, I select the round and smooth potatoes and cut them in two, in the middle, separating the stem end from the seed, or blossom end. I plant the stem end, reserving the blossom end for the table. I prefer to plant in hills three feet apart each way, putting four pieces in a hill, with the flat side down, so as to form a square. Cover the seed four inches deep. When the tops are eight or ten inches high, plow and hoe, filling with four inches more of earth, keeping the stalks well separated. Hoe no more after this. Then all they want is a good shower of rain to bring them to maturity, as they only make one setting. The pieces planted from the seed end of the potatoe will continue to put forth new tubers, and produce small potatoes during the entire season. The sprouts from the stem end will make only one

setting, and produce large, smooth potatoes of uniform size. This practice continued, will make an astonishing improvement in perfecting the potato. I think it prevents the rot also. I have been surprised that this method has not been more generally known and practiced. Hence this communication.

Mr. W. S. Carpenter, a farmer of Westchester county, N. Y., who has experimented with potatoes for more than thirty years, said such suggestions are all moonshine. Our long experience in growing Irish potatoes, warrants the assertion that it is utterly impossible to raise better potatoes from the stem end of the tuber than from the seed end. That practice is contrary to the order of nature. The first sprouts that start at the seed end of a potato are the most vigorous, and will produce the best crop; because there are deposited the best elements for promoting the growth and development of the next crop. It is the height of folly, also, to affirm that potatoes will come up any sooner or produce any better when planted with the eyes up. We have tried it till we are satisfied that there is nothing in it. And as to planting in hills, every good farmer knows that an acre will yield the greatest number of bushels when the seed is planted in drills, and not in hills.

Ripe *vs.* Immature Seed.

Mr. Owen, alluded to above, writes also, "in relation to melons, squashes, pumpkins, in order to improve the species, and increase their flavor and size, I take the seed from the stem end. I select while growing, such as I want for seed, and let them remain on the vine till they rot. Then take the rotten mass and lay it upon a shelf to dry. It is a fact that water-melons will never get any riper than the melon was from which the seed that produced them was taken. If you plant the seeds from an immature melon or pumpkin, the product will be the same. But by continuing to select the seed from the stem end of ripe melons, as directed, the green flavor of the melon, squash and pumpkin may be avoided, and their size much enlarged. Though the results spoken of may not be attained in a single season, by continuing this practice of selecting seeds from year to year, we never fail, as I have demonstrated by practical experience, to improve the quality of such vegetables."

Early Pears and Apples.

Mr. George Woodworth, Norwich, Ct.—"Will the club name the three best early pears for the New York market? Also three best early apples?"

Mr. William S. Carpenter said the best one probably is a new sort, called Merry's Seedling, originating in Ohio, and not yet in market. It will be earlier and better than the Madeline. I would name Doyenne d'Ete and Sterling.

Dr. Isaac M. Ward named Manning's Elizabeth and Bloodgood.

Of early apples, Mr. Carpenter named Early Joe, Red Astrichan and Primate.

Mr. William Lawton said the Early Bough should not be overlooked, as it is one of the most regular bearers of good fruit we have.

Potato Disease.

Mr. Lyman Read said he believed the potato disease was first developed in Scotland, in 1832, and in this country in 1844, or at least the first report of it was made by Dr. Jackson, in that year, who attributed the disease to fungus. In this opinion Mr. Teschmacher concurs, and so do many of the scientific men of Europe. At a later day, Dr. Smee found potatoes in England infected with microscopical animal life, the same as Mr. Reed supposes, he has found in every case where he has made an examination. In 1853, 1854 and 1855, the same thing was discovered by a scientific governmental commission in Russia. Whenever the tubers are exposed to an atmosphere sufficiently warm to cause them to sprout the infusoria are produced in such myriads as to affect the vitality of the vines. He exhibited some tubers which were sealed up in glass jars, when apparently in a most sound and healthy condition, which are now covered with something which appears like dust or mold, and which is shown by the microscope to be a mass of animal life. This, Mr. Read believes to be the origin of the disease which produces the potato rot. Many persons have supposed it to be an atmospheric disease, but this Mr. Read doubts because the disease did not prevail formerly when the atmosphere was the same as it is now. Vines used to grow green and vigorous until killed by frost.

Dr. Ward here inquired why, if the disease is caused by insects, always present, it should prevail one season and not another?

Mr. Read answered that it was owing to the state of the air or soil which promotes the life of these infinitessimal mites more

some years than others. Some years they appear to be nearly all destroyed. They flourish most in wet seasons or in wet soil. His recommendation therefore, is only to plant potatoes upon the dryest land.

TREES ON THE HIGHWAY AND LIVE FENCE-POSTS.

Mr. Lincoln Fay, Portland, Chautauqua Co., N. Y., says: "I have a row of cherry trees along the highway, eight feet apart, which serve for fence-posts of the very best kind; and the crop of these trees some years equals the interest of $1,000 per acre. Nothing but lightning has ever broken down the fence. I also have forty rods of chestnut trees, eight feet apart, along the highway, which I am also using for fence-posts. I have also thirty rods of maple set the same distance. Opposite the maples stand a row of sixty early Astrachan apple trees, giving an abundance of fruit to the owner as well as to travelers. Cherries, chestnut and apples furnish fruit, and in a few years the maples will yield sugar. These trees add beauty and value to the farm. Upon a new line of road just opened, I have planted apple trees twelve feet apart for fence-posts, as I have found eight feet closer than necessary. If a wind-break as well as fence-posts be desirable, it is better to plant the trees eight feet apart. Upon all division lines ash trees might be planted and cut for fuel at the hight of the fence, as the stumps will always send forth sprouts. In planting trees along the highway, the most serious trouble I have had has been to get the cattle law enforced. Copperheads, hen-roost robbers, and all that class, against which we have to guard our graneries, with lock and bolt, call me 'hard to the poor,' because I won't suffer their cattle to steal a precarious living in the highways, although I allow them to cut all the grass on the road side."

RED-BUD OR JUDAS TREE.

Mr. H. T. Hoxie sends some seeds of the above tree, "the flowers of which are bright red, shaped like those of the garden-bean, starting before the leaves, and growing in clusters upon all the old branches, so thickly do they hide the limbs. Soak the seed in warm water until they sprout. (I succeed thus with Osage orange seed.) Please give the true name of this tree?"

Mr. Solon Robinson.—The true name is Cercis, though it is well known among botanists as Judas tree. It belongs to the order Leguminosæ. From seeds sown in spring, and transplanted to

rich loamy soil, in a sheltered situation, flowering plants may be obtained in six or eight years, in the latitude of New York, if the young plants are treated with some slight winter protection. The Cercis blossoms at about the same time as Laburnum, Guelder Rose (Snow-ball), Hawthorn and Flowering Dogwood (*Cornus-Florida*), with which its red blossoms contrast beautifully.

The Study of Botany.

Mr. Wm. K. Griffin, Fulton, Oswego Co., N. Y.: "This is the season of flowers, and the best time in the year to begin the study of botany. Almost anybody, with a fair English education, and a good degree of perseverance, can pursue the study of analytical botany, without the aid of a living teacher. All that is necessary is a suitable text-book. Thirty-five years ago 'Eaton's Manual of Botany' was in vogue. Undoubtedly, some better work can be found now."

Mr. Solon Robinson.—The text-book of Botany by Prof. Gray does not fill the want. It is doubtless a good work for one far advanced in the study. It is a blind guide to new beginners.

Mr. Griffin says: "When a botanist discovers a wild flower of which he wishes to ascertain the name, he readily determines to what class and order it belongs, by examining those little organs which are found in the center of nearly all blossoms. Then by comparing the other parts of the blossom with the descriptions of genera arranged under the given order, he determines to what genus it belongs. He now turns to another part of the book where the genera are arranged in alphabetical order, and here, under the given genus he finds a list of species. Now, by running the eye down this list and comparing the descriptions there given with the green parts of the plant in hand, the specific name is discovered. In this place is also given the English name by which the plant is known. The generic and specific name, together, constitute the expression by which the plant is spoken of among botanists."

Yes, Sir, this is just what the botanists find easy to do. This is what the new beginner cannot do. It requires years of patient study, careful practice, and the correction of a thousand mistakes to arrive at this point without a teacher. We do not agree with Mr. Griffin that botany is a science so easily obtained. We do contend that it is one which should be taught in every common school to every farmer's child of respectable intelligence. It should be the statute law of every State that no person should be

employed as the teacher of a school, in a rural district, who was not able to teach at least the rudiments of botany in general, and particularly in that locality. The technical names may be easily acquired, explained and understood. All that is needed is a teacher who knows a cabbage from a cabbage rose.

Mr. G. says : "The study of botany leads us to the fields and groves there to study the beautiful order of nature. It combines bodily exercise, recreation and mental activity, and is therefore the study of all others to 'drive dull care away.' It has also its practical uses. In the common names of plants there is great confusion. Many familiar plants are called by one name in one locality and by a different name in another ; and a great many seem to have no name at all. Thus we have had a discussion lately as to what is blue grass. One man writes from the west about wild buckwheat, and no one present seemed to know what he meant. Had this correspondent been a botanist he could have made himself understood. Our May weed is known in some parts of the country only as dog fennel, and in others as wild chamomile. I should like to see this interesting but much neglected branch of knowledge revived."

One of the most useful works to be had is one lately published by Tilton & Co., Boston, "Flowers of the Garden," which gives common botanical names.

The Rain-fall of 1865.

"The following table shows the highest and lowest range of thermometer (with date prefixed), the mean temperature, amount of rain and snow (in inches and tenths) for the year 1865. Meridian—north latitude 43 degrees 10 minutes, west longitude 74 degrees 56 minutes ; height above the sea, 835 feet, at South Trenton, N. Y.:

Date.	Max.	Date.	Min.	Mean.	Inches Rain.	Inches Snow.
Jan. 22	40	26	22	20	5.70	57
Feb. 26	48	13	15	26.4	4.75	24
March 16	54	12	8	25	6.35	8
April 29	56	9	28	40.1	7.20	1.25
May 17	78	11	30	55.6	2.85	
June 18	92	14	50	70.2	5.40	
July 28	86	13	50	66.9	5.77	
Aug. 4	89	29	42	64.9	1.22	
Sept. 10	88	20	40	68	2.96	

Date.	Max.	Date.	Min.	Mean.	Inches Rain.	Inches Snow.
Oct. 11	70	25	24	43.7	4.78	2
Nov. 1	50	1	32	36.8	2.42	21
Dec. 27	50	16	12	27.12	3.72	19.12
					53.12	132.37

"By adding the snow melted to the rain, it makes 4 feet 5 inches and 12-100 of water fallen this year—12-100 less than 1864.

"There were 24 days of thunder this year; on the 12th of May the hills of Oneida county were covered with snow."

The Tomato as Food.

A good medical authority ascribes to the tomato the following very important medical qualities:

1. That the tomato is one of the most powerful aperients of the liver and other organs; where calomel is indicated, it is one of the most effective and least harmful medical agents known to the profession.

2. That a chemical extract will be obtained from it that will supersede the use of calomel in the cure of disease.

3. That he has successfully treated diarrhœa with this article alone.

4. That when used as an article of diet, it is almost sovereign for dyspepsia and indigestion.

5. That it should be constantly used for daily food. Either cooked or raw, or in the form of catsup, it is the most wholesome article in use.

Information for Emigrants.

Mr. J. G. Mitchell, Ralston, Lycoming Co., Pa., who has traveled extensively during the past winter through the south, gives the following valuable information for emigrants to Florida: "Isothermal lines in Florida are very irregular and arbitrary. Northwesters are more frequent and severe on the Gulf than upon the Atlantic coast; northeasters the most so on the Atlantic; but they seem to become modified in their passage across the water, and are not so cold as a northwester on the Gulf. For instance, on the 15th and 16th of February, at Pensacola, a northwester of three days' duration, ran the thermometer down to 20 deg., killing the leaves of the oleander, curling up those of the orange,

and fairly freezing off those of the acacia, which were about an inch long. Nothing of this kind was experienced near the eastern coast. Cape Canaveral, lat. 28.30, seems to be about the southern line of frosts, while Charlotte Bay, on the Gulf, nearly two degrees further south, has frequent frosts. I brought home a piece of sugar cane, grown near this cape, produced from a root seven years old, while in the same latitude in Texas we know that frost destroys the cane annually. In summer, on the contrary, the heat is more intense upon the Gulf, it being land-locked and out of reach of the ocean breeze. The difference in winter is caused by the near presence of the Gulf-stream, which hugs the shore as far north as Cape Canaveral, on the east coast, while the Gulf is kept cool by the immense volume of ice-water poured into it by the Mississippi and other rivers reaching the regions of snow and frost. Vegetation is always more advanced on the east coast, and even the St. John's river, only 30 miles from the coast, is more subject to killing frosts than the coast itself, which confirms a remark made by you some time since, that early garden vegetables upon that river were not a sure crop. One killing frost is as good as a dozen. I see that green peas from Charleston are selling in New York for $25 per bbl. At Smyrna peas were ripe in March, so were tomatoes. We had also new potatoes, cabbages, turnips, lettuce and onions. Smyrna is 36 miles north of Cape Canaveral, and the Gulf-stream is there forty miles from the coast, so there is occasionally both frost and ice at Smyrna. Oranges, lemons and figs, however, succeed uniformly. The gale of last October blew off a large proportion of the fruit, but the crop is usually a sure one. I picked those I gave you on the head of Indian river, from a grove of 1,700 trees, the only grove of much account below St. Augustine. The State is not as swampy as it appears by the maps. The great body of the land is sandy pine land, with oak and cypress hommocks interspersed. The swamps were a swindle, got up to cheat Uncle Sam and the North out of the most valuable land in the State. You are acquainted with the history of that operation, and will not be surprised to learn that I have walked over many a mile of the *swamp* lands ceded to Florida, on a dry, sandy road, that never saw water except on a rainy day. The pine timber is usually small and scattering, and much injured by the annual fires. The grass is also thin and coarse, though I saw some fine Bermuda grass at St. Augustine, and a kind of clover, very thick, and about a foot high,

with a small, yellow blossom. They both grew very thriftily in the white sand. The owner complained that he could not get the Bermuda grass seed, and had covered his lawn by root propagation. Raw shells are a favorite dressing for land, and on the coast are abundant. Fish, also, in unknown quantities, can easily be caught and, used, as manure, will insure a crop on the sandiest land. Calcined lime seems too hot for that climate. The lumber business is sure to be overdone in this State. In Pensacola there were in March thirty-five mills located, and the Washington Iron Works, at Newburgh, alone had orders for eighteen mills for Cedar Keys. Other places seem supplied in due proportion. I have already tried your patience, so I will close by giving you an answer to your question as to the safety of northern men. So far as the eastern coast is concerned, it would be sufficient to say that from the head of Halifax river to Jupiter inlet, 150 miles, by a width extending often quite across the peninsula, there are not inhabitants enough to make a respectable school district. The general fact, however, is, that a census taken to-day in the entire State, would show as many northern as southern inhabitants. Fernandina elected a yankee ticket in March, and I notice that Florida yankees are radical and aggressive. I have no confidence in the love borne us by Johnny Rebs, but they are fond of our greenbacks, and if there is one State more than another that sees the benefit of northern immigration, it is Florida."

Mr. Mitchell proposes to establish a colony in Florida, of good, industrious northern families. He says: "The business I propose to engage in is that of raising tropical fruits, and early fruits and vegetables for northern markets, shipping fish, turtles and oysters, producing sugar, rice, &c., and opening commerce with the north. The portion of the State I have selected for this purpose is upon the eastern coast, about 100 miles south of Jacksonville, and 300 south of Savannah. The inlet from the sea is a good ship channel, and communicates with Halifax river, Mosquito lagoon and Indian river, which run parallel with the coast a distance of 200 miles, and are navigable by small steamboats through nearly their entire length."

We presume those who may be interested in such a project can obtain further information by correspondence with Mr. Mitchell.

Adjourned.

May 22, 1866.

Mr. Nathan C. Ely in the chair; John W. Chambers, Secretary.

Vermin on Stock—Ticks and Lice.

Mr. S. A. Todd, Ripley, Maine: Ticks and lice are among the pests to farmers, and the remedies (all called good) are often greater pests. Forty years' experience has confirmed me in the use of the following remedy. I raise a little tobacco every year which I cut before frost comes, wilt it on the stock, hang it in the barn for a month or two, and in damp weather pull off the leaves and pack with a little straw in a tight cask. About haying time, I kiln-dry it, with care not to scorch, and in a common salt mortar reduce to powder. When well sifted, I apply it, with a common pepper box to the sheep's back in the crevices of the wool on both sides, the whole length of the sheep. If ticks are plenty repeat the operation in three or four days. If ticks are found on young lambs, sift on a little of the tobacco. At shearing time apply to all the lambs. One pound of tobacco is sufficient for fifty sheep. The result, when I do it well, is that I have more sheep than ticks the next fall. The same remedy is equally beneficial to cattle. But the great secret in exterminating lice on cattte lies in the fact that a very few (just enough for seed) remain in the mane, ears, or about the horns of cattle during the summer, and at the approach of cold weather begin rapidly to multiply. To exterminate all, I apply soft soap diluted with strong salt water to the parts named. With this remedy carefully applied, farmers will soon have more cattle than lice on their cattle.

Knitting Machines.

Mrs. Joseph Yates, of Delaware, Ohio, asks by letter what is the best knitting machine now in use, and whether any of them are desirable?

Mr. Solon Robinson.—The Lamb machine, manufactured in Springfield, Mass., and the Dalton, manufactured near Norwich, Conn., are the best known, and the latter is probably the most serviceable of the two.

Timothy—When to Cut.

Mr. C. S. Paine, Randolph, Vt.: "The question should not be, at what stage will it produce the most weight, or bulk, or, perhaps, nutriment, if that nutriment is turned to a hard crusty shell of wood, and cannot be made available to the animal that consumes

it. Such hay may be best for a city consumer, where he cuts, and, perhaps, steams it, to make it tender, but I think not for the farmer. I have noticed that animals are much more fond of hay cut at least before all the heads are in blossom. I have noticed that if after feeding such hay you change to timothy cut after the seed is ripe, they will look at the feeder, as much as to say, I want something better. And then again you will find the mice will burrow in such hay, and you will find it full of chaff and chankings. A man of my acquaintance cuts his timothy mostly before in blossom, and always finishes before it is out of blossom, and it is astonishing to see how much stock the bulk of his hay will keep, the hay looks almost like green grass, his sheep and cattle fat on it, and so far from the sod deteriorating it is improving every year, and he winters more stock on the same number of acres than any farmer I am acquainted with. His crop of rowen is almost as good as the first crop."

Mr. Alfred Young, Gustavus, Trumbull Co., Ohio: "My father cut timothy when in full bloom, and I know that he fatted cattle on that kind of hay, without grain, or other feed. Also one of the best dairymen in this township says that cows will give much more milk fed on early mown hay than late. I have always believed that ripe timothy was not much better than straw. It is what I call grass-straw, being woody and fibrous, but with little nutriment."

Mr. Solon Robinson.—Thus we see that farmers as well as doctors disagree. Who shall say which is right?

Horse-Hoeing.

Mr. Solon Robinson.—Mr. Mechi, the celebrated English improver, lays down this excellent axiom: "Never employ a man where you can use a horse, and never a horse where you can work a steam-engine." The reasons are obvious: a man costs as much daily as a horse, while the latter has six times the power; a steam-engine beats the horse in like proportion; therefore, with Garrett's horse-hoe, which takes a width of seven to eight feet, a pair of horses and one man will clean and cultivate from eight to twelve acres a day. With two pair of horses my man has occasionally clean horse-hoed from twenty to twenty-two acres of wheat or beans in a long day. Our beans are harrowed well with iron harrows, when they are one inch out of the ground, and receive in addition two or three horse-hoeings and two hand-hoe.

ings; our tares are sometimes horse-hoed, and our clovers are invariably hoed in the spring, if there are any weeds to remove. A truss of clover will pay the cost of hoeing an acre.

Growing Forest Trees.

Mr. Geo. W. Morgan, South English, Keokuk Co., Iowa, sends us some very encouraging words for those who live on the prairies, where there is a necessity for growing forest trees. Mr. Morgan says: "I have 350 maples, twenty to twenty-eight feet high, four to eight inches diameter, from seed planted in 1858. I have locust, grown in the same time, equally large, or larger, without any extra care. Plant the seed like peas, and but little space will be needed for many thousand trees. At one year old plant them out in rows and tend like corn. Maple seed falls in the latter part of May, and then is the time to plant it. If you can induce every owner of prairie land to plant a few seeds every year, what a change will be wrought in the looks and solid improvement of this open country."

How to Plow Fruit Orchards.

Mr. S. Edwards Todd.—The usual manner of plowing the ground around fruit trees is most injurious and ruinous to their growth and productiveness, as the plow cuts off nearly all the most important roots. The roots that grow near the surface of the ground are the great absorbents of nourishment, whether they are roots of trees, shrubs or plants that yield fruit. This is a habit common to plants and trees to throw out a system of roots near the surface of the soil, where they will absorb and readily appropriate the fertilizing matter with which they come in contact, to the purpose of developing the stems, or fruit of the growing plant. If we examine fruit trees, around which the soil has not been plowed, nor spaded for three or four years, it will be seen that a system of roots has been formed near the surface of the ground. Let these roots all be cut off and another set will be formed in their place in a few years. Or, if a mound of earth be raised one foot high around the body of the tree, a system of roots will soon appear near the surface of the ground. Then if the height of the mound be increased another foot, another system of roots will be produced, except with very old trees. We once raised a mound of earth two feet high, around a young apple tree, and a set of roots more than one foot long was formed in one sea-

son, about one inch below the surface of the mound. We once employed a man to transplant fruit trees, who sat them so deep that they barely lived, from year to year, for three years, when they commenced growing rapidly. Upon examination, it was discovered that every tree had produced a new system of roots, not more than one inch below the surface of the ground ; and as soon as the roots had attained sufficient size to take up a fair share of nourishment, the branches began to grow. We well remember, when a small lad, that a large apple tree was removed from the kitchen garden to the orchard, in the winter, when a large ball of frozen earth adhered to the roots, and was planted in a large, deep hole, previously dug to receive it. Unintentionally the tree was planted several inches deeper than it stood before removal. The consequence was, that the tree made no growth for several successive seasons, because it was planted too deep.

Yet as soon as a system of roots near the surface of the ground was sufficiently long and large to supply an abundance of nourishment to the branches, the top began to grow rapidly, and produced an abundance of fruit ; and up to the present writing it is a thrifty tree in full bearing. These facts are sufficient to prove that roots near the surface of the ground are essential to the growth of trees and plants, or nature would not be so prompt to reproduce a new set as soon as practicable after the surface roots have been removed. The habit of producing a set of roots near the surface of the ground is not confined to trees and shrubs, as the stems of wheat, Indian corn and other grain, if the seed be buried three, four or more inches deep, will immediately send out a set of roots near the surface of the ground. And if rich soil be piled around the stems before the blossoms have appeared, another system of roots will appear just below the surface of the ground. From these facts, we can at once see and appreciate the eminent importance of simply skimming the surface of the ground with the plow for several feet distant from the trees. In order to do the work neatly, a gauge wheel should be secured beneath the end of the plow beam, and adjusted to allow the plow to run to the desired depth between the rows of trees. Then, as the plow approaches the trees, the plowman must lift on the handles. By this means all the most important roots will not be disturbed by the plow, and the trees will grow much more rapidly and produce more abundant crops than if all the secondary roots be torn up and cut off by the plow. When we were accustomed to plow young orchards,

the entire surface for four or five feet on each side of the body of the trees was not plowed more than one or two inches deep. The earth was kept mellow and free from weeds by the use of hand hoes, and none of the secondary roots were mutilated if it could be prevented. The result was trees of every kind grew much more rapidly than they otherwise would have done had all the secondary roots been cut off with the plow.

Gas-House Lime.

Gen. Butterfield, New York, writes: "What is the value of gas-lime for agricultural purposes? The question appears to be a mooted one."

Mr. Solon Robinson.—Gas-house lime, when first thrown out, is worse than useless for a farmer—it destroys, rather than fertilizes the plants. The only way to make it available is to expose it for a long time to the atmosphere—at least four or six months. Spread out a few inches thick, and turn over and over several times, that it may be thoroughly aired and washed by the rains. Then take it in time of a drouth, when in a condition of dry powder, and apply it to the land, or store it in a very dry place for future use, in the same way, and for the same purposes you would gypsum. It will not pay to haul it far and put it through these manipulations, where plaster and pure lime are as cheap as in most parts of this country.

Protecting Young Grape Vines.

Mr. Wm. Smith, Newfield, Ind.: "Last fall I piled up the soil among my young grape vines, a foot high, to protect them through the winter, having lost several the year before. They were found, when uncovered this spring, in a very healthy condition."

Sheet Iron Chair Bottoms.

A newly patented chair bottom was then exhibited to the club. It is constructed of sheet iron, varnished yellow, and not easily distinguished by appearance from the cane bottom. They may be fitted to seats of any shape or size, and furnished at half the expense of ordinary cane seats. They are made by the Tice Manufacturing Company, 110 East Twenty-ninth street, New York.

Thompson's Portable Fence.

A model of a patent portable fence was then exhibited by the inventor.

The advantages claimed for such a fence over common permanent board or rail fences, are first, the facility and ease with which they may be taken up and removed to any desired locality; second, the fact that it can be adapted to any surface however uneven, and third, its cheapness, the entire wood-work, including posts, costing at present prices of lumber, three dollars per rod.

The convenience to every farmer of possessing a limited amount of portable fence, is too palpable to need comment. No well conducted farm should be without, at least a hundred lengths. There is much fencing that is not required to stand more than a single season, such as that built around hay-stacks, sheep pens, hen yards, &c. Very many times, if a light portable fence were at hand, it would be used where it would not be required to stand more than a week or month. As a mere convenience for such purposes such a fence would be inestimable.

Another advantage of this portable fence is that it may be folded up and placed under cover during the winter season, and thus preserved for a long time. A gentleman present said, he thought the cost of the fence had been estimated at too low a figure, by the inventor. Reply was made that whatever might be said in reference to the cost of this fence would apply equally to all other kinds constructed of timber.

Silver's Patent Excelsior Broom.

Mr. Peck exhibited specimens of these brooms. The broom consists of three parts; the handle, head or holder, and loop. The loop is fitted into the handle by means of a screw. The holder is a case of tin, sheet brass or German silver, as the purchaser may prefer, which clasps the upper part of the brush, extending down about one-fourth of the length of the brush. The loop is filled with the corn rightly prepared for the purpose, the holder placed over, and then the loop screwed into the handle. Whenever the brush becomes too much worn, the farmer can insert a new supply of corn, and his broom is new again.

On motion of Mr. Bull, it was

Resolved, That this club welcome the presence of Dr. Isaac P. Trimble, of New Jersey, the entomologist of the Horticultural Association of the American Institute, after his labors during the past winter at Trenton, and that our thanks are hereby tendered to him for the valuable information he has from time to time com-

municated to the club in regard to insects which are destructive or injurious to vegetation.

Mr. Carpenter moved that a committee be appointed to attend the Strawberry exhibition at Hammonton, N. J., on Wednesday, May 30th, 1866, at which an invitation was given to the club at the last meeting. Adopted.

The following committee was appointed: Messrs. Greeley, Trimble, Lawton, Quinn, Robinson, Carpenter, Ely and Todd.

Adjourned.

May 29, 1866.

Prof. S. D. Tillman in the chair. J. W. Chambers, Secretary.

The Barometer.

The following letter from Mr. David Petit, Salem, N. J., was read by Mr. Solon Robinson : "In your discussion of 24th of April last, the utility of barometers, as indicators of the weather, was again brought in question. Although one of your club believes that depending upon barometers is all stuff, and that the Almighty sends his rain when he will ; and that we can only guess it is coming, permit me to say in response, I do not question the fact that God rules the universe, nor do I question the fact that the elements by which we are surrounded, are governed by the same power, but by fixed laws ; and if these laws are not comprehended by some would-be wise men, that is no evidence they do not exist, nor is it any evidence of insanity in those who search out these laws. Your reporter says : 'The rules as laid down in all scientific works, and cards, and advertisements of barometer-makers, are utterly fallacious,' and admits it would be beneficial to base our calculations opposite to the rules laid down, in which view one of your club coincides, and suggested that farmers should communicate the result of their observations, whether they were able to foretell the state of the weather, days or hours in advance. In which view I heartily agree, and send the result of my observations. The great difficulty has been that scientific men have all based their calculations on false premises, and then attempt to bring the elements and the barometers to square with these false premises. They have started with the false notion that rain is caused by the attraction the earth has for the clouds, when they fly low—as they do with a light atmosphere, consequently it must

rain when the air is light, or very light, and be very dry when the air is heavy. I have a barometer, marked on the face of it, stormy at 28 inches; much rain at 28½; rain at 29; change at 29½; fair at 30; set fair at 30½. How fallacious! The plain truth is I have never seen the barometer to 31 but once, and never so low as 29 inches. It generally fluctuates between 29½ and 30½, and much the larger part of our rain storms commenced with a heavy atmosphere, and are raging a long while above 30 inches—marked on the barometer fair; and most all our damp, humid weather is owing to or exists when the air is heavy or barometer stands above thirty. I have known but two important rain storms for the last five years, to commence with barometer below thirty inches, hence the disappointments of the purchasers of barometers. Rain or snow does not depend upon the state of the air or barometer alone, but in connection with other circumstances, and they are humidity of the atmosphere, connected with the height of the barometer. If the air is not humid, rain or snow will not fall with any state of the barometer. If it is humid, and the barometer is high, that humidity will continue until the barometer falls, when it will rain or snow, and continue to, until it reaches a point sufficiently low to indicate a dry N. W. wind. The reasons are obvious: The movements of the barometer are governed by the courses and velocity of the wind. A southwardly or eastwardly wind depresses the barometer, and if these winds commence or blow with a humid atmosphere, as they are generally loaded with vapor, rain must follow where the barometer falls. On the other hand a N. W. wind generally raises the barometer, and as this wind is generally dry, fair weather must follow. Therefore, a low state of the barometer is an indication of dry weather, and a high state of the barometer, if the air is humid, of wet weather, thus reversing the rules laid down by the men of science. The above, as general rules, will hold good. They have been for nearly four months past susceptible of nearly universal application. The exceptions in these cases were on the 7th of first month, (Jan.) barometer 30½, thermometer 26 degrees, north wind commenced blowing and raised the barometer by next morning to 31 inches, and sunk the thermometer to ten or twelve degrees below zero. The barometer then fell to 30.25 inches with a N. and N. W. wind. The other was fourth month, 17th (April), barometer raised with an east wind, then changed to S. W., and after four days' humid atmosphere, the barometer fell with rain. On referring to a diary kept,

I find the wind has blown from the N. W. forty, or more than half the days, since spring commenced, mostly with a light atmosphere, and as a general rule, the lower the barometer has been, the harder the wind has been. I trust the above rules will bear a practical application, and therefore offer them for the consideration of the public."

Prof. Tillman.—There is no doubt in my mind that we shall yet reach such a state of information, as to foretell, with a good deal of accuracy, the condition of the weather. At present I am willing to concede that whoever depends upon such scientific instruction as has already been given, or upon the barometer, and the rules laid down, will fail most signally, because that instrument changes with the wind, and a change of wind does not always, nor generally, indicate rain in this latitude.

Mr. Hicks said that it was an almost universal rule upon Long Island, that rain would follow a change of wind to the northeast, and it scarcely ever failed that the barometer rose, and, according to the rules laid down, indicated fair weather, at the very time storm was approaching. He believed it was the settled conviction of many persons who had purchased barometers, that they are useless implements for farmers.

Dr. Crowell said that there were many plants that were better indicators of approaching rain storms than the barometer. What farmers need more than buying these instruments is to observe things around them.

How to Make Coffee.

Prof. Chas. A. Seeley.—The virtue of coffee consists in its volatile aroma and its fixed extractive matter. The happy combination of these with hot water is the problem for the coffee-maker. This happy combination, in my opinion, when realized in perfection, implies that all the aroma and all the extractive matter of the ground coffee be got into the hot water and retained there. It seems to me that no argument is required to show that any aroma which escapes into the air, or any extractive matter left in the grounds is so much virtue wasted. Now, to get at the same time the whole of these constituents of coffee, has seemed very difficult. If boiling water be filtered through ground coffee —this is the French plan—the aroma is promptly extracted, and very little else, for the fixed matter needs more coaxing. If the

ground coffee be boiled a long time in water—the Turkish and more common American plan—the aroma escapes with the steam. The French waste the extractive matter; the Turks, the aroma. The plan which secures one of the ingredients allows the other to escape. My coffee-making is a continuous process, and may be carried on for a life-time. It takes two days to get regularly started, but after that there is a daily routine. To begin, I take more than the usual amount of coffee, and pour on it hot water when it is ready to be used; in other words, I make French coffee. The grounds from this operation I leave to soak in the pot till next day, when I begin coffee-making by pouring hot water on these grounds, which hot water I use according to the French plan in making coffee from fresh ground coffee. The process is now in full operation, and every time coffee is wanted the manipulations of the second morning are repeated. I thus extract all the soluble and useful matter of roasted coffee, and waste nothing. To put the art in the most practical form, I have found it necessary to modify the coffee pot. Perhaps the simplest apparatus is the most ordinary pot provided with two strainers. The strainers are of cup form, and fit into each other and into the top of the pot. For use I set a strainer on the top of the pot, and into the strainer I place fresh ground coffee; over this I use the second strainer, containing the grounds of the last operation. Now hot water is poured into the upper strainer, and percolates down into the pot, carrying with it all the goodness remaining in the grounds, and the aroma and much of the extractive of the fresh ground coffee. When the water has passed down, I throw away the now useless contents of the upper strainer, and upset the contents of the lower strainer into the pot. Delicious coffee is now ready to be served to the appreciative household.

Concrete Walls and Barn Cellars.

Mr. M. B. Walker, Riverside House, Minot Corner, Me.—I want advice from the American Farmers' Club. I am about to build a barn, 40x60, with a stone-walled basement on three sides, the other, or yard side, to be supported by open posts. Now, would you not recommend underground stables, and the composting of the manure with muck, through the winter, rather than to have them above, with manure cellar underneath? Will not such composted manure be worth enough more than that worked by hogs in a cellar, to pay for the extra labor? In my old barn I

keep my cattle in the basement, putting a foot or two of muck under the stalls, in autumn, and removing it in spring. The cellar of the basement is to be dug in sand, never needing other than its natural drainage. Having no large stones for these basement walls, can I make them of concrete? The best and cheapest methods of building barns, and making and preserving manure, are subjects worthy the attention of farmers generally; and, if such walls, in a soil like mine, can be built of clay and stone, they ought to know it."

Mr. Solon Robinson.—You can make concrete walls of lime and gravel; one to five, but not with clay, unless it is very pure and strong or mixed with iron. As for manure cellars, under barns, they are often great nuisances. The plan you propose is the far better.

Bread Making.

Mr. S. E. Todd read a letter from a "farmer's wife," about bread making, and the difference in quality and wholsomeness of hop-yeast bread over that made by milk-rising or salt-rising.

The chairman, Prof. Tillman, said in answer to these queries: "When the changing nitrogenous material in the gluten of the flour comes in contact with the saccharine matter, the compounds, alcohol and carbonic acid, are broken up; and the carbonic acid gas, in its endeavor to escape from the mass, is retained by the expansion of the tenacious gluten, in the form of round globules, which are disseminated through all the dough. If, therefore, the process of fermentation be allowed to go on long enough, lactic and acetic fermentation will also set in, producing lactic and acetic acid, which will shortly accumulate so largely as to render the entire mass unfit for bread. The reason why hop rising is superior to milk rising for making bread is found in the fact that the lupulin in the hop checks the rapid decomposition of the albuminous matter contained in the gluten of the dough, and also the decomposition of the saccharine matter, prior to the commencement of the acetous fermentation."

Mr. S. E. Todd.—The entire subject of bread making is replete with interest. No plausible reason can be assigned why one kind of bread is more healthful for one person than that which was made with different yeast. Some good livers relish bread made with hop yeast, and cannot like bread the dough of which was raised with milk-rising. And the opposite of this is as frequently

the case. Chemists have stated that a cold solution of hops, instead of boiling them, as is the usual practice, will retain a sponge for forty-eight hours, and dough may be taken from it at any period, which, if baked, will make superior bread.

Dr. Crowell.—I have lately learned an important fact in regard to yeast, which should be known to every house-wife. If the hops are steeped in a cold solution, instead of hot, the dough is preserved from acetic fermentation much longer. Indeed, bread made from dough mixed at the same time showed no difference, baked 48 hours apart.

Moving Large Trees.

Mr. B. Hathaway, Little Prairie, Ronde, Mich., objects to moving trees with a frozen ball of earth, as the very worst possible plan, because the exposed roots freeze and retard the growth of the tree. "I dig a wide trench about the tree to be transplanted, in the spring, work under it, cutting the roots, until it can be tilted over on the side. I slope the bank, run a stone-boat under it, straighten it up, so it will rest on the boat, and draw it out, with one or more teams, as is necessary. The hole should be dug to receive it, then, by a little care in driving, not directly across the hole, but a little to one side, the tree can be deposited in its new place, tipped down again, the boat removed, straightened up, the earth filled in, and the work is done. I have some 30 apple trees that were transplanted, after growing eight years, that are now in good bearing state; indeed, the transplanting seemed simply to remind them that they had something more to do in this world than merely to grow, they being mostly of the Northern Spy, that before their removal showed only premonitory symptoms of fecundity. I have also 20 or more cherry trees transplanted this spring, as above described, that are now in full blossom."

Potato Bugs—Iowa.

Mr. M. H. Bishard, Des Moines, says: "They are here by millions. The only chance of getting any potatoes this year is to make war upon the bugs. I take a paddle and basket and beat the bugs into it, and kill them with hot water. Our experience with potato bugs teaches that we can only raise potatoes by the sweat of our brow. Imagine me standing, basket and paddle in hand, in the midst of a patch of potatoes, with from 6 to 12 bugs on each hill, and you will have a photograph of my patch."

Cure for Film Over Cows' Eyes.

Mr. Jonathan Farnum, Uxbridge, Mass.: "Pulverized glass, blown into the eye, is a sure remedy, and will cut off the film. This we have known from boyhood and seen practiced, and affirm whereof we know."

Best Soil for Growing Strawberries.

Mr. S. Edwards Todd.—The experience of the best and most extensive gardeners and growers of small fruit in the country, will coincide with this conclusion. And yet, the conductors of a certain illustrated periodical, specially devoted to pictures and the relentless pursuit of "Humbugs," having nothing else to do, take exceptions to our conclusion that a sandy soil is better than a stiff heavy soil for raising strawberries; and they state, in a most bigoted manner, that "no one who knows anything about strawberries, would ever put a sandy soil down as an important requisite." How then does it occur that on the heavy, stiff soils all over the country, where large crops of wheat will grow annually, it is utterly impracticable to raise more than two-thirds as many berries per acre as will grow, with half the hard labor expended, on the drifting sands of Vine Land and other parts of New Jersey and Long Island? Why do gardeners in all parts of New York, Canada, Ohio and other States, select the very lightest soil for strawberries, instead of the stiff, heavy clays, while on certain strawberry fields, last March, in New Jersey, the wind actually drifted the sandy soil in many places several inches deep, and we frequently saw it whirling about our feet? On those very sandy fields, in ordinary seasons, $1,000 worth of berries, clear profit, can be picked from every acre. We saw half an acre of this drifting sand covered with strawberry vines from which $600 worth of berries, clear profit, was picked last year. The same man may cultivate strawberries on a heavy clay soil till he is as gray as "old Graybeard himself," and he would not be able to produce such a bountiful crop. And the same is true of melons. Farmers in the wheat growing districts of the Union, have tried for years to grow melons. But they failed to do it profitably and successfully. Yet on the sandy soil of Long Island and New Jersey they have only to put in the seed and apply a small quantity of fertilizing matter, and melons appear by the wagon load with a little labor. On the sandy soil they are unable to raise a heavy crop of wheat. But strawberries and melons, requiring

little or no clay, flourish most luxuriantly, where wheat and some other cereals will not yield satisfactory crops.

Mulching Strawberry Vines.

Mr. Solon Robinson read a letter from Mr. N. C. Meeker, Dongola, Ill., concerning the cultivation of strawberries. He thinks, with them, nothing is equal to Wilson's early variety, which is exceedingly prolific. They lost most of their last year's crop, because they failed to mulch the vines. He says, had we mulched our vines, we should have raised a bountiful crop of berries. He urges people to apply a heavy mulch of straw to all their vines, as that will not only keep the ground moist, which is essential to the perfect development of the fruit, but the straw will keep the fruit out of the dirt, so that it will be clean.

A Caterpillar Exterminator,

Exhibited by W. S. Carpenter, was made of card teeth, in a cone shape, about eight inches long, and one and a half inches diameter, fastened on a pole, to insert in nests and twist them out of the limbs.

Dr. Trimble put the very pertinent question, whether the trouble of cleaning the implement of the webb would not more than counterbalance its advantages.

Caterpillars can be killed, says C. Arms, Knox county, Ill., by saturating the nests with soap-suds, made with two quarts of soft-soap in twelve quarts of water. The work should be done in the hottest part of a clear day.

An Improved Pitchfork.

Mr. Montgomery, Williamsport, Penn., exhibited a pitchfork, which every one conceded to be an improvement upon the old style, as the tines are made separate and fastened to the sides of the staff, instead of being joined to a shank, which is inserted into a hole bored in the center of the staff, and which it is often difficult for a farmer to do, when necessary to make repairs. Another advantage the present fork has, is that when a tine is broken, it can be replaced by a new one in two minutes, or in case a farmer has a number of similar forks, he can make one good one out of two broken ones. These tines are firmly fastened to the sides of the staff by a little turn in the shank, that enters a hole, and by the ferule, which is driven down from the upper end, and held to

its place by a short wood-screw. The whole appears to be a valuable improvement for farmers.

Wet Cellars.

A farmer's wife inquires "whether she can cement her cellar bottom with plastic slate, to keep the water from oozing up?"

Mr. Isaac Hicks.—I would not advise it, unless you can wait a long time for it to dry, as the odor of the gas-tar would be unpleasant; beside the plastic needs the sun or fire-heat to harden it so it can be walked upon. Still, I have no doubt it would stop the water. I have lately been trying this plastic for a variety of things, and do not think that half its use and value have yet been discovered. I have completely mended some old brass-kettle bottoms, which had become useless. I can make very cheap, durable under-drain pipes out of hemlock boards, nailed together and coated with plastic slate, and I intend to use it to coat pigs' troughs, making them tight, and preventing the pigs from eating the boards when they get soaked. For any kind of water-gutters the substance is invaluable.

Information for Emigrants.

Mr. Solon Robinson.—Mr. Powell writes from Crossville, near Sparta, White county, Tenn.: "As there is an opinion to the contrary, prevalent, I wish to tell the people of the North, through you, that they may come into this county of Cumberland, Tenn., to remain here as permanent citizens, or merely as visitors, and that they will be welcomed by the inhabitants, and treated with all the respect and kindness they could reasonably ask for. They will be just as safe in their persons and property as they are in their present homes, and I see nothing to lead me to suppose they will not continue to remain safe. Our courts would protect them in their rights, if any person should infringe upon them. They will find thousands who are ready to sell them land at a low figure, and give them good titles. On these cheap lands they can produce bountifully every kind of grain, root or fruit, that belongs to a temperate climate. They can till the lands with ease—they will not have to contend with the stone, and clay, and mud of the North, and East, and West, nor with their diseases. They will find a plenty of wild deer in our extensive forests, and no musketoes to prevent them from having first-rate sleep through our cool nights. If the invalid comes with his dyspepsia, or bronchitis, or liver complaint, or almost any other of the long cata-

logue of diseases which your physicians try to cure (and cannot, but which the patient pays well for), they may come with the expectation of casting off the burthen, which they do not wish to carry. If tens of thousands of the citizens of your great city were here, instead of there, they might be much better off than where they are now. If the poor man, who is able to labor, would come here, and go to work with his muscle and brain, he might rapidly work his way up to, at least, competence. If the man of small means would come here and invest them wisely, and be industrious and economical, he might greatly improve his condition. If the rich man who loves to go any summer into the wilderness of Northern New York, where he is almost devoured with musketoes and gnats, to hunt the deer, would come, he would find this much better ground for sport, for he would find ten deer here to one there, with the additional comfort of thousands of fruit in the fields and orchards, and health in every breath of atmosphere. It is said that potatoes do not succeed well at the South. They do here, at the rate of five hundred bushels per acre. The soil is sandy loam; climate salubrious; elevation about three thousand feet above tide-water. Sweet potatoes also flourish, and wherever grass and clover have been tried the result is satisfactory."

Manufacture of Cotton Cloth in Texas.

J. R. S. Vanvleet.—I have just returned from Texas. I find some situations there very desirable for improvement. At New Braunfels, a Mr. Torrey, from New England, has built a cotton mill, upon a very excellent water power, formed by immense springs that burst out from the foot of a hill at the distance of a quarter of a mile, giving a fall of thirty or forty feet in a mile and a half, and a good sized stream never affected by drouth. Mr. Torrey is manufacturing brown sheetings about twenty per cent cheaper than they can be in Massachusetts, owing to saving of transportation of cotton and cheaper provisions. He pays girls fifty cents a day and gets plenty of help. This part of Texas is mostly settled with a first-rate class of industrious Germans, and it is an excellent region for wool growing.

Mr. John Slosser, Tiffin, Seneca Co., Ohio, says: "The trench of a foundation concrete wall should be dug two feet wider than the wall is thick, or it will not dry. Concrete will not do in wet cellars, nor in trenches that freeze before the concrete is entirely dry."

WHITEWASHING TREES.

Mr. Slosser says: "Your club condemns whitewashing trees. If you will mix air-slacked lime in hot water, and put it on the tree in freezing weather, it will cause the rough bark to peel off."

So will any caustic wash. Mix hot lime with water, and let it settle until clear, and wash with that lye and see if your rough bark does not peel better than when whitewashed.

HOW TO GROW PEACHES IN COLD CLIMATES.

Mr. V. C. Mason, Berlin, Waukesha Co., Wis., has succeeded in growing peaches where the thermometer runs down to 30° below zero, by training the trees low, and covering them in winter with boards and earth, at very little expense. He sets posts in the line of the row, upon which a ridge pole is fixed, which supports one end of the rafters, the other end resting on the ground, and these being boarded with cheap refuse boards, are covered with a thin coat of earth, which is gradually removed early in spring, in time to prevent injury to fruit buds. The only kinds he recommends for culture, under such circumstances, are Serrate Early York, Fay's Early Ann, Cole's Early Red, Early Barnard, Cooledge's Favorite. The last named has done the best.

Mr. Mason says: "By protecting this way a crop of peaches here is as sure as a crop of potatoes. This mode of protection is of course best adapted to a timbered region like this, where covering material is cheap and good peaches very high. My crop last year brought $6 to $8 per bushel.

Mr. Hicks said that of all his variety of peaches the "Snow Peach" was the only one that exhibited any blossoms this spring. This is an American seedling, very hard and productive; skin white, fruit large, globular, flesh white and juicy, ripening in fore part of September. The blossoms are small and white, the foliage and young wood light green.

Mr. Baldwin stated that he had some peaches upon trees in city lots, and a gentleman who lives back of Nyack, said that while peach buds were all killed there, he had a good many apricot blossoms upon cions grafted upon wild plum stocks.

PLANTING LIMA BEANS.

The regular subject of the day, "Spring Planting," was then taken up.

Mr. P. T. Quinn said: In many parts of the country, the Lima bean cannot be grown with satisfactory success. The soil best

adapted to the production of this kind of beans is a deep, thoroughly pulverized clay-loam, free from excessive moisture. Indeed the Lima bean will not succeed on wet and cold soil, nor on those that are very porous and dry. He has been accustomed to cultivate his ground to the depth of twelve to eighteen inches, either with the spade, or by means of the subsoil plow; and they had frequently raised from one thousand to four thousand fold of beans at one crop. He sticks his poles about four feet apart each way, setting them firmly in holes made with a crowbar. The poles should not be over seven feet high.

In order to give the young beans an early start, he spreads a liberal dressing of well rotted barnyard manure around each pole where the beans are to grow. The fine manure is covered with earth after it is spread around the pole. Then a small circular channel is made around the base of each pole into which the beans are stuck, with the eyes downward. This is to facilitate their coming up well. If planted with the eyes up, or on the sides, unless the soil is exceedingly light and mellow, the beans will not come up, whereas if the eye be down, the growing stems will push the beans to the surface of the ground without any difficulty, even in a heavy soil. And even when they do come up, if planted on the sides, they will appear above ground several days sooner, if they are stuck in, one at a time, with the eye down. He plants six or seven beans around each pole; and thins them, after they have come up, to three stalks in a hill. If the runners do not cling readily to the poles, they should be put around them, and tied with some elastic strings until they will sustain themselves. The ground should be kept clean and mellow, and free from weeds and grass. When the climbers have reached the top of the poles they should be pinched off. If allowed to keep on growing a long and heavy growth of vines will be the result, with but a small crop of beans. The vines of beans always go around the poles toward the rising sun, while hop vines climb in the opposite direction. If vines be put around the poles the wrong way they will refuse to grow, and if left free will unwind and climb in the opposite direction. Let a vine be put around a pole in the opposite direction from its natural way to climb, and fastened there, and as the end grows longer, it will turn directly around and go up the pole in the opposite direction. It is highly important to aid the vines in clinging to the poles, as the crop will be much lighter if the vines are allowed to run a short distance on the

poles, and then fall down. He was accustomed to use Knox's cultivator, for weeding his beans. Others thought there was no other horse implement superior to Alden's Horse Hoe. He had used Peruvian guano for top dressing beans.

Dr. Crowell coincided with Mr. Quinn, adding that he considered Peruvian guano as one of the very best special manures ever used for Lima beans. He would use on each hill about a teaspoonful, largely mixed with earth as a divisor, and apply it to the surface of the hill after planting the seed.

Mr. J. A. Montgomery, Williamsport, Penn., stated that he had raised Lima beans for many years past, but they could not be raised successfully in some localities, especially where the soil is cold, wet and heavy.

Mr. Isaac Hicks, North Hempstead, L. I., said that a distance ot two feet nine inches apart was sufficient. Four feet was further than necessary. He plants ten beans around each pole, always planting the seed shoal, as they come up with difficulty.

Mr. P. T. Quinn stated that the true way to select seed for the next year's crop is to allow the first set, and first ripe pods to remain for seed, instead of eating them, which is eminently important, in order to produce beans early in the season. A part of the best row should be selected for seed, and no beans taken from it for the table. By this means, in a few years, the beans will ripen much earlier.

Mr. Wm. Lawton.—There is a spurious kind of seed, more round, thicker and smaller than the true sort, which are broad, flat and thin on the edges.

Ajourned.

June 5, 1866.

Mr. Nathan C. Ely in the chair; Mr. John W. Chambers, Sec.

Lower Story Sleeping Rooms.

Mr. S. M. Parsons, Waukan, Wis., writes to the Club as follows: "If you have a cellar under your house, or the underpinning be such as to prevent a free circulation under it, your family will gain more strength by sleeping up stairs than they will expend by going up stairs 'ten times a day.' But if your house is not over a hole in the ground, and is so elevated as to admit a free circulation beneath it, your family may as well sleep in the lower rooms, provided they are properly ventilated. But a house over

a hole in the ground cannot be sufficiently ventilated to secure vigorous health to its occupants, however well it may be constructed, for the reason that a hole in the ground cannot be ventilated, even were it in the middle of a ten-acre lot; and the gas which accumulates in all such places is the same as that which is commonly called 'the damps' in old wells. Being heavier than atmospheric air, and generated by every decomposing object, it rapidly accumulates in cellars, and having an affinity to the mephitic gas generated in sleeping rooms, the gas in the cellar, aided by the humidity of the night-air, is drawn up into the bed-chamber, and, being inhaled, poisons the blood of the unconscious sleeper. Houses ordinarily constructed, even without cellars, have a foot or more of carbonic acid gas (damps) on the floor, preventing a proper circulation of blood; hence the complaint of cold feet by the women, and the disposition of office men to hoist their feet upon chairs and tables, to secure a better circulation. Let an office be properly ventilated, and that bad habit would cease. For a room to be properly ventilated, it must perform all the functions of a living being, which are essential to life. A current of air should be introduced in contact with the stove, so as to be warmed before it comes in contact with the occupants. The heavy gas that accumulates upon the floor should be drawn off by a syphon pipe, connected with the stove, and the light air that rises to the upper part of the room should, by a like syphon method, be drawn into the stove, so that all the offending gas and effete matter may be carried off by the way of the chimney, by a current that will constantly change the air of the room. The rule should be, make the air inside the room plenum to the air outside, by force of current, at any degree of heat required. The practice of shoving up and down windows, to let in fresh air, is more dangerous than to continue to breathe over and over the same air, but in either case life is put at hazard. It is just as necessary that the air should be tempered for the skin as the lungs, when a person is at rest."

Strawberries in Illinois.

Mr. N. C. Meeker, Dongola, Ill.—We cultivate Wilson's Albany, for no other kind compares with it. Our first shipment was made ten days earlier than common, May 8. Last summer was very wet; many plants blossomed in September; frequently we picked messes of very fine fruit in November, and some even

in December. Our girls picked a few, frozen solid, on New Year's day. Hence the forwardness this spring. All warm climates are very dry. You can see what would be the result if they were as moist as cold ones. There would be a second growth and development of buds and blossoms, which the frosts of winter would kill. Our only salvation is the long drouths, which utterly dry up the grass. We had a fine setting of strawberries from reserved buds. But there has been no rain from the time they blossomed till picking commenced, and still there is none. The fruit has shrunk to the size of small bullets, and the green ones are withered. The crop is only a little more than half picked, but we have ceased to ship. In a few uncultivated, weedy and grassy places the fruit is fresh and fine. Had we thickly mulched straw around the plants, so as to keep the ground moist, the crop ought to have been sure. It is difficult always to get straw. One engaged in the strawberry business ought not to neglect the straw part. Perhaps if rye had been sown between the rows last fall, it would have been a great help. Our plants were well cultivated, they grew very large, and many are in hills. We expected work would pay. The larger the plants were, the poorer and smaller is the fruit. So many berries were set that they could not mature. Plants of moderate size and tolerably close together did best. I am sorry to say I hear of no settled plan. The more I have studied and expended, and the harder I have worked, the less successful have I been. Next year we expect to do better. We have set out new grounds, because we have found that we cannot get a first-rate crop except on young plants, and that old plants are nearly worthless. We think we have learned this for certain; if we have, it is the only thing we have learned. I do not know that it is right to tell it, but I will, though I do not want anybody to take me as a guide—the largest crop I ever raised was where the only work done was to mow off the weeds in the fall, and hoe out a little grass in March. There were a great many plants, but the fruit was scandalously small. I have a faint conviction that a little work is all-important, that the land should be good, and that much work is a damage. But let nobody listen to me, for I really know nothing about it. I have raised strawberries ten years, and know less than when I began. Still, whatever be the cultivation, there is, in this section, no other crop so sure. Even if it fails, and there are no more than ten bushels to the acre, we get more money than from anything else. One year with another, the price

has averaged nearly $7 a bushel net. Commission men have 10 per cent, freight is 3½ cents a quart to Chicago, and the girls get 2½ cents for picking.

Peach Tree Pruning.

Mr. H. B. Beagle, Bricksburgh, Ocean county, N. J.: "What is the proper time and manner to shorten-in peach trees, and will it pay to do it after the trees begin to decline? What kind of salt is used for land by members of the club?"

Mr. Solon Robinson.—The shortening-in process may be tried at any time during the growing season—as well now in June as any time. Cut off all the decaying limbs, or ragged ends, so as to bring the top into good shape. It will sometimes save a tree to prune after it begins to decline. Refuse salt, from packing houses, is the kind used. It formerly, when used, as reported by Solon Robinson, at the rate of 20 bushels per acre, at three dressings, cost six cents a bushel. It is now worth 15 cents. At six bushels per acre, it is economical manure.

Mr. P. T. Quinn.—We begin early in spring to shorten-in all the defective limbs, and sometimes cut back to a mere stump; often cutting off half or two-thirds of the growth of the previous year. This seems to prolong life, which at best only continues five or six years. If I were pruning to increase the fruit, I should do it in June or first half of July.

Tomato Trellises.

Mr. S. E. Todd.—If the vines are growing in rows, the best, cheapest and most convenient supports for tomato vines can be made by driving stakes into the ground in a line with the plants, and nailing narrow strips of boards on each side of them. Pieces of scantling, two by four inches, three and a half feet long, will make stakes about the correct size. Sharpen one end, and drive them about one foot into the ground, with the wide way of the stakes across the rows. The stakes should be about six feet apart. Then nail three strips of inch board, two inches wide, on each side of the row of stakes, so as to allow the tomato vines to grow up between the strips, which will be four inches apart. To prevent the vines falling down lengthways between the slats, corn cobs or round sticks eight or ten inches long may be placed on the upper edges of the strips, to support the falling vines. This style of trellis will keep the tomatoes up off the ground, the vines will grow erect, the fruit can be plucked without tearing the vines to

pieces, fowls will not be so liable to eat those that ripen first, and the vines will be much more productive than if allowed to grow while prostrate on the ground.

Are House Plants Healthy?

Mrs. Charles Curry, Factoryville, Wyoming county,' Pa.: "Is it healthy to have house plants in the rooms we constantly occupy, or otherwise; and the reason, as there have been various opinions expressed on the subject here? Also whether verbenas will grow from seed. I have a scarlet one just budding to blossom, and I would take pleasure in gathering the seed for distribution, if I could procure information on the subject?".

Mr. Solon Robinson.—Plants are not considered by those who best understand the laws of vegetable growth as healthy companions in a sleeping room, or, indeed, in any room occupied in any way during the night, because the exhalation then given off contaminate the air, particularly in the blooming season. We do not believe that plants should ever be kept in a common sitting room, in winter, unless it is extremely well ventilated. Verbenas are produced from seed.

The chairman said that it was contended by some persons that plants absorb gas that is deleterious to health.

Mr. Burgess said that no room could be healthy, in the night time, that had growing plants in it.

Cement for Broken China.

Mrs. Julia A. Thompson, Paw Paw, Mich., in answer to an inquiry for a good cement for broken china, says: "White lead and copal varnish, mixed to the consistency of thick cream, make one of the best cements for china and glass-ware that I ever saw. I have articles in use nine years, that have been mended with this cheap cement. Bind the parts firmly together until dry."

Mr. S. Edwards Todd indorsed this statement from his own experience, having mended a large bowl, which withstood use and water, hot and cold, many years.

Dr. Crowell.—The white of an egg, mixed with a little of fine flour of air-slaked limed, is a first-rate cement, and it can generally be had in every farm house.

How to Make Cheap Cement Cisterns.

S. Edwards Todd.—Where the ground is so compact that it must be dug up with a pick, cisterns may be made by spreading

cement on the ground, without laying a wall of stone or brick on the inside. Let the hole for the cistern be dug 4½ or five feet in diameter, round, or of an elliptical form, and make the sides smooth with a mallet by pounding them. Excavate the bottom so as to make it a little concave, say four or five inches lower at the middle than at the outside. Cover the side and bottom with hydraulic cement, half an inch thick; and as soon as the mortar is nearly dry apply another coat as thick as the first. The top may be covered with plank, flat stones, or a brick arch, having a manhole in the middle, or near one side. When a cistern is plastered on the ground the cover should be put on before the sides and bottom are plastered. If the earth is soft and there is quicksand in some places, a course of brick or stone may be laid up in cement and afterwards plastered as if it were a wall. Such cisterns should be covered with at least 1½ feet of earth, to exclude frost, as freezing the sides, where the cement is applied to the ground, will usually cause the cistern to leak. Some persons fear that a coat of mortar on the ground will not be durable. If the cement be good such a cistern will last for a hundred years or more. As soon as the mortar is dry the cistern will be as firm as a stone jar set in the ground. After the cement has become hard it will not render the water hard. Cisterns should be made in dry weather, when there is no water veins to encounter. When a large cistern is covered with plank, posts may be placed in the cistern to support the middle of the covering. If a cistern were made beneath a barn, or in a large barnyard, to exclude liquid manure, the planks that are used to cover it should be well covered with cement, and after it has dried a coat of pitch should cover the cement. This will make it water-tight.

Wooden Cisterns.

A mechanic who has sufficient skill to joint two boards so as to make a tight joint, may make a wooden cistern for a few dollars, which will last a life-time. Saw out the staves about six or seven feet long and four inches wide. The staves can be made of stuff 1¼ inches wide, or 1½ inches thick. Every stave should be one-fourth of an inch narrower at the top than at the bottom, so as to make the top of the cistern smaller than the bottom. If much otherwise it would not be so convenient to hoop it. Let all the stuff be well seasoned before it is used. Then make the bottom of plank, dressing the edge true, and of a uniform thickness. Dress out the staves by beveling the edges, so that the

joints will be tight on the inside, and open nearly or quite one-sixteenth of an inch on the outside. Make the croze in each stave so that it will drive on the edge of the bottom of the cistern, water-tight. Nail each stave as it is put on. After hooping it, give the outside a bountiful smearing with coal tar or pitch, and put the cistern in its place, puddling the outside with clay. We have in mind a wooden cistern that has been in the ground for forty years and is good still.

INFORMATION FOR EMIGRANTS.

Mr. Joseph Mounts, Columbus, Ind., wants "advice about going farther West, and whether a young, single man, with a small capital, say $800 and a team, would do well by buying stock and feeding it on the Illinois prairies. I am a renter here, paying half my crop for the use of the land."

Mr. Solon Robinson—Then, as soon as you secure and sell your present crop, start for any of the States west of the Mississippi, and buy just as good land, or take up a tract under the Homestead law, and pay rent no more. With the start you have, you may become an independent farmer, and have land to let yourself in ten years.

Mr. Russell S. Borden, North Easton, Washington county, N. Y. The following is the report of two neighbors, who have lately traversed Northern Missouri: "No waste land; no springs; scarcely any wells of water; what is used by the inhabitants mostly is cistern water, and from the creeks and rivers; for cattle and other stock they scrape out large holes in the ground, and the rains fill them up. The soil is from three inches to seven or eight inches, of kind of black muck, and then hard pan, of the hardest kind; so hard that when they dig a cistern it needs no cement or brick, as they will not cave in; and they decided that when the soil was worn out it would be a barren country. They said no waste land; they mean by that the soil was all hard land—no swamps; trees a little more forward than here, but grass not so forward."

Mr. A. M. Swan, Oregon, Holt county, Mo: "I desire to call attention to this portion of Northwestern Missouri. Holt county is mostly rich, rolling prairie. The soil is a deep black loam, very fertile, and overlying a clay sub-soil. All kinds of fruit, except peaches, succeed well. Pears are especially well adapted to this

climate and soil. Vineyards have been proved and are successful. Fall wheat will make about three good crops out of five. Land is selling at prices ranging at from $2.50 to $10 for unimproved, and from $8 to $30 for improved, according to location and character of improvements. Holt county is loyal to the core—not a county in the State more so."

Mr. Martyn E. Pell, Fort Scott, Bourbon county, Kansas: "There is room in Southern Kansas for a few more yet. We have a healthy climate; rich soil; coal in abundance. Timber is somewhat scarce, but in lieu of it we have plenty of good building stone, both sand and limestone; short winters, and plenty of grass. Improved land can be bought here for from $5 to $25; unimproved, from $1.25 to $10 per acre. There is very little Government land in this county."

The Bark Louse.

Mr. H. Stoner, Ogle county, Ill., sends a sample of the way his apple limbs are infected, and inquires what is the matter.

Dr. Trimble—It is the common bark louse. The best way to get rid of them is to wash the trees with caustic soda or potash-wash, about the time the eggs are hatching.

Mr. P. T. Quinn said—We always wash our trees in April, which keeps them smooth and clear of insects.

Barren Strawberry Plants.

Mr. J. E. Ingersoll, Cleveland, Ohio, sends specimens of strawberry blossoms, and asks why, though his plants grow vigorously and blossom freely every year, they bear no fruit. He bought them for Triomphe de Gand, but the description is not at all like that variety.

Mr. P. T. Quinn answered—The trouble is, that this is a pistillate flower, and needs some other sort planted with it for a fertilizer. The Boston Pine is one of the best sorts for this purpose.

Plum Trees.

Mr. Wm. P. Hayden, Raymond, Me., inquires whether it "would not be a good way to keep insects from plum trees to plant cedars among them?"

Mr. Solon Robinson—We have the authority of Charles Downing that it would not only keep the insects away, but fruit also.

Melon Bugs.

Mr. P. T. Quinn—To keep off melon bugs, I put twenty-five

pounds of tobacco stems in a barrel of water, and after soaking some time, I add ten pounds of soft soap; with this I thoroughly syringe the young plants. I have been successful with this remedy. The barrel can be filled up several times; I afterwards sprinkle slaked lime over the ground.

The True way to use Spent Tan Bark.

Mr. S. Edwards Todd.—If wet tan bark be spread in a stable or yard for the purpose of absorbing the liquid portions of manure, it will take up but a very little of it, because it is already so full of water that there is not room for any liquid manure. Therefore unless it is nearly dry before it is spread in the stable or yard it may as well be spread directly on the soil, and thus save handling over once or twice. Spent tan bark ought always to be deposited in an open shed, where it will dry out before it is needed in the stable or piggery. Dry tan bark will absorb a great quantity of liquid manure, which will rectify the acidity of the bark, and at the same time hasten its decomposition as soon as it has been mingled with the soil. Dry tan bark will also make excellent bedding for any kind of animals ; and, it will retain what it has absorbed, much better than any kind of straw. When it is used for bedding, a few bushels should be spread on the floor beneath the animal, and as soon as it is well saturated with liquid manure it should be removed, and a fresh supply placed beneath them. If tan bark be used for littering sheep, it should be covered with damp straw, to prevent its getting into their wool. Dry tan bark is valuable in a piggery, as it will increase the bulk of swine manure, and thus make the manure go further when it is mingled with the soil, or when used as a top dressing for grain, or grass, which is very desirable, and important also in distributing manure that is as concentrated as are the drippings of fattening swine. The manure that is made when spent tan bark is used will be a very excellent fertilizer to apply to the soil when it is being prepared for a crop of roots of any kind, as it supplies the plants with an abundance of those salts which are essential for promoting their luxuriant growth. What has been said of spent tan bark is equally true of sawdust, turning shavings, and short shavings of planing mills, and they should all be used in the same manner ; but, if they be wet, they cannot absorb liquid manure.

The regular subject of the day, "Spring Planting," was then taken up.

The Parsnep.

Mr. P. T. Quinn.—The value of parsneps for feeding stock is not properly appreciated. We have used them for fattening pigs, for feeding milch cows and work oxen, and count them superior to any other roots. They increase the quantity and improve the quality of milk, and they certainly make cheap, sweet pork. We have never found any better feed for work oxen than parsneps. We cut them pretty fine in a machine, and feed a pair of oxen half a bushel at a time, three times a day. To grow a crop, it is well to commence preparing the ground the previous year, by planting some crop that will keep the soil clean and deeply worked. Then plow in autumn, and again in spring, with turning and subsoil plows, twelve to twenty-four inches deep—the deeper and looser the better, and the more well rotted manure you work in, the heavier will be the crop. The land must be rich, deep, and mellow, and free from sticks, stones, or hard lumps, or the roots will grow forked, and of much less value. To make a profitable crop, you must grow long, straight, smooth roots. If coarse, unfermented manure is used, the seeds are apt to fail. When ready to plant, turn two furrows together, so as to raise a bed three inches high, which is raked smooth and a trench opened with a bayonet hoe, in which the seed is dropped by hand; taking care not to cover too deeply. No machine answers to drill parsnep seed, and that kept over one year is apt to fail, unless it has been very safely kept. Hung up in a bag, in a dry room, is the best way to keep seed. The drills are twenty-four to thirty inches apart, and seeds are sown much thicker than they are intended to grow, mixed with radish seed, to mark the rows and enable us to put in the horse-hoe much sooner than otherwise. It is one of the most important things to begin early, and keep constantly ahead of the weeds, as the work can then all be done with horse or mule, except thinning out, and a little weeding from the row, at a cost of $5 to $10 an acre, by German women. If weeds are neglected, they sometimes make a costly crop. Care must be taken in thinning out, as parsnep-tops are poisonous, when wet, to many persons. A well managed parsnep crop costs no more labor than a potato crop. We sow in April, May, or early June. For winter use, we dig and store in pits in autumn. Those for spring may be let stand where they grow. In harvesting, we run a subsoil plow close to the row, and that loosens the earth so that a man can pull the roots out easily. The produce has been from

300 to 1,000 bushels per acre. We make our pits about six feet wide, and raise to a sharp ridge, and cover with straw and dirt. Those we dig in spring keep well till June. The long, smooth roots are selected for seed.

The Carrot.

We sow by machine, about three lbs. seed per acre. Sowed by hand, it will take four to four and one-half lbs. We mix radishes with carrots also. Sow from May 10 to June 10. All the preparation of land and cultivation is similar to that for parsneps. In storing, more care must be taken to prevent freezing. We cover the pits two feet deep, and put coarse manure on the north side over that. We get 150 to 600 bushels per acre, and found ready market this year at sixty-two cents a bushel. For horses, carrots are valuable, fed with oats or meal. We give half a bushel at a feed, three or four times a week.

Mr. E. Baldwin said he had a horse which had been badly foundered, which is always lame while fed on oats, and never lame when fed on carrots.

Mr. J. S. Burgess said the prize crop of parsneps in England was grown in black sand, covered with barley sprouts, from the malt house. It is recommended not to wash the roots when fed to pigs, and they fatten very fast upon parsneps, which can be grown cheaper than beets or carrots.

Adjourned.

June 12*th*, 1866.

Nathan C. Ely in the chair; John W. Chambers, Secretary.

Strawberries.

There were several varieties of strawberries on the table to-day, and some beautiful roses contributed by Mr. Burgess, who showed his two seedling strawberries, Garabaldi and Gen. Grant, both fine large fruit of good color and flavor. E. Williams, Montclair, N. J., showed Cutter & Downer's seedlings as the earliest varieties he has ever grown, particularly the latter, which is of excellent flavor and fair size, and productive. In connection with strawberries, Francis Bull, Newark, N. J., recommended Green Prolific, Russell's Prolific, New Jersey Scarlet, Cutter's seedling, Triomphe de Gand, and Agriculturist, in their order, as the choice sorts for that locality. He also invited the club to visit his place next week

and see a new strawberry called Durand's seedling, in bearing, which is thought by Seth Boyden, the originator of Green Prolific, Agriculturist and others, to excel them.

Strawberry Exhibition at Hammonton, N. J.

Mr. Solon Robinson from the committee to visit Hammonton. N. J., made the following report:

In making this report, I have not been able to submit it to other members of the committee, but from what I have previously learned from them, I am pretty sure it will meet their unanimous approval. If not, let any one speak, and his objections shall be considered.

The committee was composed of twenty members of this club, not lacking in capacity of observation, and not easily influenced in their judgment by anything but tangible facts. It embraced in its composition five of the six gentlemen who visited and reported upon Southwest Jersey last autumn, to wit: Dr. Trimble and P. T. Quinn, Newark; E. Williams, Montclair, N. J.; John G. Bergen and Solon Robinson, New York, and among the others I may mention Charles Downing, Newburgh, N. Y.; A. S. Fuller, Ridgewood, N. J.; G. G. Bergen, L. I.; Dr. Crowell, New York; Dr. J. V. C. Smith, Boston; Isaac Hicks and brother, L. I.; John Tamer, publisher of *The American Farmer*, Rochester, N. Y.; Mr. Allison, editor of *The Working Farmer*, New York, and others though of less distinction, of no less intelligence and respectability.

Squankum Marl.

From our limited opportunity of observation through Monmouth county, we are unable to give particulars, but from what we saw and heard from those who know, we are satisfied that the most sandy portions of this county are being rapidly redeemed to profitable cultivation, by the use of squankum marl, which is delivered along the line of the Raritan and Delaware Bay railroad at eight cents a bushel. Applied at the rate of 100 bushels per acre, it gives a dressing equal to or better than an ordinary dressing of stable manure, and upon these light soils produces a much better effect, for it enables the cultivator to get a good paying crop of almost any kind of farm product, though of course the best returns are in fruits and market garden vegetables.

Although the season is two weeks later than usual, the sight along the road was most charming, particularly the great clover

fields in full bloom (June 6), for they indicated a course of culture that will insure any country from sterility or exhaustion from overcropping.

As we frequently saw these flowery fields side by side, with land upon the other side of the fence, exhibiting all the sterile character of "the wilderness of New Jersey," the committee were more and more convinced by every successive exhibition, that this wilderness has been misrepresented whenever it has been called barren. If naturally so, then it is cheaply redeemed by the inexhaustible beds of fertilizing material in this and other marl localities—the best of all, and most convenient to the railroad, at Squankum.

It was the common expression of the committee, and of other gentlemen present, that land capable of producing such crops of clover is too valuable to lie idle and waste, when it can be so cheaply redeemed—redeemed to produce the fine fields of potatoes, corn, and oats, which we saw in passing through Monmouth county.

Cranberry Culture.

At Manchester, Ocean county, we walked over one cranberry garden of thirty-five acres, and another somewhat smaller, and saw others still in the distance. To some of the gentlemen this kind of culture was entirely new, and to all very interesting, as it demonstrates that the worst of the waste lands of the wilderness can be brought under the most profitable cultivation. We found the cranberry vines just coming into blossom, and those of the committee familiar with the culture, were unanimous in the opinion that the thirty-five acres owned by the Manchester Land Company are equal to any young plantation we have ever seen, and certainly very promising.

We also find cranberry plantations springing into existence, not only upon this and adjoining tracts, but in various places throughout this great wilderness region, which certainly, if not soon made to blossom roses, will blossom cranberries more extensively than any other part of the United States.

At Ellwood, Atlantic county, we made the acquaintance of General E. Wright, and saw his maps and plans of 1,200 acres of land lately purchased by the "Atlantic Company for the culture of cranberries," and learned from him that 900 acres of it has been surveyed into ten acre plots, all of which are so situated in relation to small streams, that each plot can be separately flowed

by a low dike, and that it is the intention of the Company to proceed as rapidly as possible to put the whole into cultivated cranberry vines, which already grow naturally upon many acres of the tract.

Strawberries and Other Fruits.

At Manchester we found the strawberries in full bearing, that is, full for this year; Lawton blackberries in full bloom, and of most healthy growth, as were the raspberries, gooseberries, currants, pears, apples, cherries, but not the apples. All garden vegetables looked as finely as upon richer soil, but are everywhere unusually late.

At Hammonton the exhibition tables were covered, and so was the festival table, with an abundance of handsome berries of various kinds, but everywhere the Wilson predominated. We are sorry to have to report that the strawberry plantations throughout this handsome, thriving settlement, do not look as well as they did last autumn, and do not promise one-third as great a crop as last year. This is owing to some severe weather in March and April. The cultivators must resort to mulching, and the very best of material can be had from the sea shore at eight dollars a car load.

Other fruits, particularly blackberries, are very promising, except peaches, which are to be found only here and there.

We are sorry to see the fire blight just beginning upon some dwarf pear trees, and to see others suffering for the want of manure and vigorous pruning. Standard pear and apple trees, and grape vines everywhere look beautiful, and so do all the garden and farm crops. Of the latter, the committee were delighted with the immense clover fields upon the farm of the Hon. Andrew K. Hay, where we also saw a large wheat field, unanimously pronounced the best seen this year by any member of the committee.

Hammonton, Ellwood, Egg Harbor City.

We were also delighted with the general appearance of thrift, comfort, intelligence, contentment of the people and homes of Hammonton. The same may be said of Ellwood and Egg Harbor City. Such a population, with the rapid annual additions made to it, attracted by the truth of that old proverb, that "birds of a feather will flock together," is destined to redeem this wilderness to the use of civilization within the present century.

In addition to the old Hammonton tract, Mr. Byrnes has lately purchased 25,000 acres, which he is preparing for sale to new

settlers. He is building a great hotel, and handsome private houses are rising rapidly in all directions.

At Ellwood the settlement has not advanced as rapidly as at Hammonton, though it has got a healthy start, and under the agency of Gen. Wright, is now likely to go ahead rapidly. Two paper mills add to the industry of this place, and such men as Messrs. Rich & Irving, proprietors of one of them, are well calculated to infuse a go-ahead spirit into their neighbors.

There are about 50,000 acres in the Ellwood tract owned by Mr. Colwell, Philadelphia, the most of which is now open for settlement upon both sides, and adjoining the railroad from Camden to Atlantic City—a great sea-side place of resort, sixty miles south-east of Philadelphia. Ellwood Station is seven miles southward of Hammonton, and Egg Harbor City is four and a half miles further, and six miles from Little Egg Harbor landing-place, to which a side track is building.

About 30,000 acres of land were purchased here, and a settlement commenced in 1858 by a German company, and the settlement now numbers 5,000 people, who exhibit no symptoms of suffering in consequence of having chosen a barren soil. Indeed, everything shows prosperity, thrift, comfort, happiness.

We were assured by Frederick Clever, a very intelligent German gentleman, who is one of the leading members of the original company, that there are now growing upon this tract not less than ten millions of grape vines; and that the grapes produced, will make wine equal to the first-class Rhine wines, we were fully satisfied by the most practical evidence.

We were also assured that some of the German farmers are making tobacco culture quite profitable; and that hops grow of such excellence that they sold for ten cents a pound above the market price. They are also devoting attention to cranberry culture.

Absecom, still farther on, is a very old settlement, long occupied by a class of men devoted to the sea and its products, and firm believers that all the land in their rear was an irredeemable wilderness, only fit to produce a crop of wood for the coal-burners once in 20 years. The best argument in the world to prove that it was barren was, that it had never produed any food crop. It was useless to reply that no seed had ever been planted—no attempts at cultivation ever made, except upon the true Jersey plan of skinning a piece of new land until the body was dead and

useless. Yet at Absecom we found old orchards of great apple trees, and plenty of evidence to prove that the land is productive. We saw but little clover or grass, for the reason that here is an immense salt marsh, over which the railroad passes to the sandy island upon which, since 1854, this straggling village, mainly composed of hotels and summer boarding-houses, has been built, around the tall lighthouse at Absecom inlet.

At one of these great hotels, "the Chester County House," your committee dined, in company with a large addition to their number from the towns along the route and visitors to the beach, as guests of G. W. Custis, superintendent of the Camden and Atlantic road.

By direction of the committee, Solon Robinson offered the following resolution, before the company separated at the table:

Resolved, By this committee, that in consequence of the extreme courtesy with which they have been treated—such as has seldom been awarded to any similar body—we are unwilling to separate without publicly tendering our most sincere thanks for all these kind and pleasant hospitalities, to President Potter and Superintendent Clayton of the Raritan and Delaware Bay road; to President Frasier and Superintendent Custis of the Camden and Atlantic road, for their personal attention and kindness, to the gentlemen at Manchester, to whom we were so much indebted; to the ladies and gentlemen at Hammonton, who opened their hearts and houses to furnish the comforts of their pleasant homes to weary travelers; to the ladies and gentlemen at Ellwood, for an impromptu entertainment, got up with telegraphic dispatch; also, to our German friends at Egg Harbor city—and, in short, to all persons and places we have visited, for an earnest manifestation of good will and attention to us as strangers, visiting a new country, where we found unexpected friends.

In explanation, Mr. Robinson said that, unexpectedly to the committee, they had been afforded remarkable facilities for this visit. Col. Potter had put an extra train upon his road, which enabled the committee to enjoy a "lunch" at the "Manchester Club House," which, if not called a lunch, would pass for a first-class hotel dinner; and also to visit the cranberry gardens and other fruit productions at Manchester, and stop at other stations along the road, the president and superintendent accompanying us all the way to Manchester. Then we were furnished with a special train upon the Camden and Atlantic road, by which we were enabled to make the pleasant calls along the road, and enjoy

the visit to and hospitalities received at Atlantic city, where only one or two of the committee had ever been before. The saving of expense was the smallest item in the consideration of the committee, for they would freely pay largely for the delight of the pleasant memories of this trip. It was, therefore, only an act of justice to ourselves and others to pass this resolution. And it was passed with enthusiastic acclamation ; and so was one offered by Dr. Trimble, of thanks to Congress for passing the Inter-State-Commerce railroad bill, which, he said, if not vetoed, will enable the people of the United States to escape the thraldom of the Camden and Amboy monopoly, and the roads over which we have traveled to live and improve that part of the State, and, Mr. Custis said, to redeem its political character.

The Rev. Mr. Whittlesey, of Ellwood, said the obligation for hospitality and pleasure for this visit was not all upon the part of the committee, but on the part of the people of this part of the State, which would be highly benefited by being seen by so many intelligent gentlemen, and he therefore moved a vote of thanks to the American Institute Farmers' Club, and its present committee, for their attention to the best interests of New Jersey in their endeavors to promote the settlement and cultivation of its waste lands.

Want of time, strength, and space to print, if given, prevent giving extended notices of the remarks of speakers at Atlantic City and two public meetings at Hammonton, besides much practical agricultural and horticultural conversation during this remarkable trip, which will undoubtedly be like good seed sown upon good ground, and this report, imperfect as it is, we hope will be acceptable to the Club.

It is proper to state, that it was received with evident satisfaction. The members of the committee present fully concurred in the statements, and, on motion of Mr. S. Edwards Todd, a vote of thanks of the club was heartily given to the citizens of New Jersey for the respect shown to this Club, in the way the committee had been received. Mr. P. T. Quinn said that he could have truthfully stated, in stronger language than Mr. Robinson had, the manner in which the committee were received; and, in answer to some remarks made by Prof. Nash, to the effect that it was morally impossible for people to live in such a sandy region as he knew it was at Hammonton, Mr. Quinn said that he had the statistics to prove that no section of the country could show a greater net

result than the cultivated land around Hammonton. One year ago he was just as much prejudiced against all that section of the State as Prof. Nash, but he had to yield to ocular demonstration. Every one who visits the place can see for himself what the land produces, and he must believe the whole community are combined in one grand lie, or else he must believe cultivation here equally profitable with any other part of the State. Strawberry culture commenced here in 1863, and in 1865 the crop sold for $32,500. There are now growing 160 acres of cultivated blackberries. Some of these acres yielded 90 bushels per acre last year, and the prospect is most encouraging this year. So it is for everything else, excepting peaches and strawberries, which are no worse here than everywhere else. We have prided ourselves upon pear culture on the clayey lands of Newark, yet we must own now that we are in no respect ahead of the sandy lands at Hammonton, and in all that part of the State, and I must credibly acknowledge that a poor man has a better opportunity to make a living upon sandy land than upon a stiff clay soil, or upon the richest lands of the west. The only difficulty that I have found at Hammonton, or any of the other new places, is in the want of means to start with. The new settlers are not able to buy and use as much manure as would be profitable.

Country House Nuisances.

Mrs. Van Slyke, Genesee, Allegany Co., N. Y.—"You can do the country a great favor by calling the attention of people to sources of disease existing upon many farms, in the "pest houses" called privies, which accumulate their contents for years, the wash of the kitchen sometimes included, until they are not only offensive, but, according to reports in your board of health, extremely detrimental to health."

Mr. Solon Robinson.—No doubt of it, and often the unknown cause of severe fits of sickness. A reform in the construction and care of these necessary farm buildings is much needed. They can be deodorized by fine charcoal, dry muck, fine, dry clay, gypsum, copperas in solution, and several other inexpensive substances.

Early-Cut Grass.

Mr. S. Edwards Todd.—Grass cut early always makes the best and most nutritious hay. It is better for work-horses and oxen, and is infinitely better for cows that give milk than ripe grass, as

there is more available milk-producing material in it. Such hay is better for calves, as it affords more nourishment than dry, ripe grass. Hay made of early-cut grass—when the grass is in full bloom—is better for sheep of all kinds, and especially for lambs, or for making mutton, than hay that is made of ripe grass. Moreover, when hay is made of green grass the soil will not be exhausted so greatly as it will be if the crop is permitted to mature the seed before the grass is mowed. Another thing should not be overlooked in securing hay, which is to assort the very coarse portions from the fine. In some meadows there will be a few hundred pounds, the stalks and leaves of which are exceedingly coarse. By exercising a little forethought, after the hay is cured, the coarse hay may be placed by itself in the barn, where it will always be accessible in the winter. Then let it be run through a feed cutter and chaffed, and moistened with water and a little meal sprinkled over it, which will make far more palatable feed than if it is dry and uncut.

Adjourned.

June 19, 1866.

Mr. Nathan C. Ely in the chair; Mr. J. W. Chambers, Secretary.

STRAWBERRIES.

Mr. Thomas Cavanach, a Brooklyn horticulturist, made a display of several of the most popular sorts, giving a brief description of each, which may be of service to those who desire to obtain any of the varieties mentioned.

Marguerite, a very large, showy, handsome-looking berry from imported stock, is like nearly all the European varieties brought to this country, of but little practical value.

Buffalo Seedling and *McAvoy's Seedling* were shown side by side, with the request for any one, if he could, to tell which was which. Mr. Cavanach pronounced them identical. So he does the *Austin* and *Napoleon Third*. Yet these are all catalogued and sold by nurserymen as different sorts. We have often examined them, and fully agree with Mr. Cavanach in opinion. Of the two first, the name of McAvoy should have the precedence. It is a good, solid, dark-colored berry, and quite prolific. The *Austin* is said to have originated among the Watervliet Shakers. The *Napoleon Third* was sent out under that name by a Boston nur-

seryman. Under the name of Austin, it was at one time very much lauded by a prominent member of this club. By all who have grown it around New York, it is now generally pronounced a poor, soft, sour, miserable sort. It grows large and spongy; white inside, and frequently hollow.

Green Prolific, Mr. Cavanach thinks a profitable market berry, although the fruit is of poor quality. The berries are large; the plants of rank growth and prolific bearers.

The *Monitor* and *Brooklyn Scarlet*, two of "The Tribune" strawberries, Mr. C. considers among the best in his collection. The Monitor is an excellent market berry; it bears transportation better than the other.

Triomphe de Gand he does not value as highly as some other persons do. Although it grows large and sells well, it is somewhat tender in our severe winters.

La Constante, although only moderately prolific, is one of the very best varieties he has.

French's Seedling, a great favorite in Burlington county, N. J., Mr. C. finds does remarkably well upon the sandy loam soil upon Long Island. The vines are prolific, berries large, but rather too soft for long transportation.

Jocunda or "700" is not yet ripe, nor does it promise such excellence as it does at Pittsburgh upon Mr. Knox's strong clay soil.

Feast's Fillmore, another of Mr. K.'s favorites, has not proved at all successful upon Mr. Cavanach's soil.

Garibaldi, one of Mr. Burgess's seedlings, is a good variety, prolific, large berries. The objection to it is the same as Wilson's—the fruit stalks are too short.

Brighton Pine is simply good, nothing extra.

Black Prince is an old sort; a shy bearer; too dark colored for a market berry.

Scott's Seedling, a very handsome, long cone-shaped berry, better for private than market gardens.

Lady's Finger; a very high-flavored, excellent sort, medium size, moderately prolific.

Russell's Seedling; prolific, large, soft, and sour. Yet Mr. Cavanach considers this and Wilson's Green Prolific, neither of them first quality, the most profitable for market gardeners.

Manning's White is a good sort for those who like white strawberries.

Victory was wrongly named, if the originator thought he had obtained success.

Welcome, one of Mr. R. Prince's seedlings, proves a sorry sort for cultivation with Mr. Cavanach.

Hooker's Seedling is one of the best he grows.

Dr. Hallock exhibited a plant (Wilson's), taken up this morning from his garden at Milton, Ulster county, N. Y., seventy miles up the Hudson, to show with what vigor strawberries grow at that place. The bed was planted in August, and highly fertilized with wood ashes, and now generally exhibits an average of sixteen fruit stalks to the plant. This one has twenty, fully loaded with berries.

Professor Nash inquired if it would answer to manure and turn sod for planting strawberries. Mr. Cavanach said that he had tried that plan this year, and found his plants making such a miserable growth, that he intends to dig up the ground and make a new plantation.

Coal-Tar as a Disinfectant.

Mr. J. H. Tompkins, Grand Rapids, Mich., urges upon the attention of all persons the importance of coal-tar as a disinfectant. A small quantity added to the contents of a privy, renders it so inodorous that it may be emptied and mixed with soil and formed into a valuable guano without being offensive to the workmen.

Mr. George Bartlett.—There is a most important article in the last number of the *London Chemical News*, by William Crooks, its editor, who was one of the government commission to make experiments and discoveries to prevent the spread of rinderpest in England. Chemists and physicians were generally in favor of the use of chlorine and ozone as disinfectants. It is now well established that chlorine substances are deodorizers and not disinfectants, and that preparations derived from coal-tar are not only deodorizers but disinfectants and destroyers of the virus of epidemic diseases, such as rinderpest and small-pox. The theory now pretty well proved is that this virus is a germ analagous in character to the yeast plant and similar substances, which have a wonderful power of reproduction from minute germs. The distinction between a deodorizer and a disinfectant, is this: the first destroys odor, the last destroys or prevents infection. Odor is usually harmless, though it often has coupled with it an infectious virus which produces disease.

Carbolic acid is a white crystalline substance, distilled from coal, that mixed with sulphurous acid makes the best deodorizer and disinfectant combined that has ever been discovered. Mr. Crooks has proved its capability of utterly destroying all virus. In one of his experiments he dipped one piece of putrid meat in chlorine, and one in carbolic acid. Both were deodorized, but the smell returned in ten hours to that treated with chlorine. He then coated a piece of fresh meat with carbolic acid, kept it ten weeks, soaked it a short time in water to dissolve the coating, and then cooked and ate the meat, which was as fresh and sweet as though just from the butcher.

Mr. S. Edwards Todd said he had proved that coal-tar used in considerable quantity in the privy created a more sickening smell than the contents without tar. It may answer if immediately cleaned out.

Lupine.

Mr. Samuel Carpenter, Ocean county, N. J., inquires if he can grow lupins as a fertilizer for sandy land.

It is so used extensively in Europe, particularly in Portugal. Its growth is rapid, and like clover, it draws alkali from the subsoil. It is considered admirably adapted for enriching sandy soils. It is a leguminous plant, fibrous-rooted, perennial. It is not as good as clover for hay, and for some reason has been but little grown in this country.

Insects from Wisconsin.

Mr. C. H. Greenman, Milton, Rock county, Wis.—"I send a piece of limb of soft maple, covered on the under side with what we call bark lice. All the limbs on the trees are in the same way, and the trees are failing. What can we do to rid the trees of this pest, which is new to us? We are all interested in this prairie country, where thousands of these trees are planted yearly. The Iona and Israella grape-vines are all dead, as far as I can learn, in this section. Mine, three years planted, are dead, root and all. Delaware, Concord, Rogers's Hybrid (Nos. 9 and 13) are all right; Hartford, Allen's Hybrid, and most other sorts, are more or less injured."

Dr. Trimble.—This is one of the multitude of bark lice which affect various trees, but do not destroy them. We see them here very common some years, and the next year none. This cottony substance which you see attached to the limbs contains the eggs.

Mr. John G. Bergen—This has been a hard winter upon grapevines. My Ionas and Israellas are not killed, but are so small and feeble at three years old, they might as well be dead as alive. About ten years ago Isabellas and Catawbas suffered greatly. Grape-growers must not be discouraged by one extra hard winter.

Dr. Trimble said the "Union Village" was very badly injured at Norwalk, N. J.

Insects in Salt.

Dr. Trimble exhibited a specimen of salt, infested with insects which breed in that substance. This he did to show that salt is not destructive to all animal life.

Roup in Fowls.

Mr. P. P. Bates, Schuyler's Lake, Otsego Co., N. Y.: I would say to Mr. Geo. L. Squier, of Buffalo, that his fowls undoubtedly have the roup. I have sometimes thought it developed in fowls something like diphtheria in human beings. It is contagious but not epidemic. It is sometimes originated by dampness and filth in the roosting place, impure air from ill ventilation, unwholesome food, brackish or stagnant water, and especially by roosting in a building exposed to a draught of air. Fowls like to roost high and dry, and let no air blow on and beyond them ; let one or two sides of the roost be impervious to wind or storm. The general directions in poultry books is to kill roupy fowls at once, that is as soon as attacked, if of common stock. I would do so; if valuable, I would try my luck with a few remedies. I have lost valuable fowls with roup, and I have saved some with it, so blind for days that I had to put all their food and water down their throats. Remove to a dry, warm place ; warmth, even close to the fire is grateful and very beneficial to them ; pure cold water, if able to drink, and corn, wheat, or rice for food ; a good dose of calomel (and I am not particular as to amount), and jalep or common garden rhubarb to purge them, wash the mouth and nose in alum and vinegar, bathe the throat in some irritating liniment, and I have sometimes given ten or twelve drops of Organum oil in a teaspoon of Olive oil, or lard, with very marked remedial effect, and always, and frequently put a small quantity of red pepper, dry, into the mouth and throat. Powdered charcoal is sometimes beneficial, as the development of the disease is very corrupt and offensive. I saved a beautiful little African Bantam cock bird by giving him

wine to stimulate and keep up strength. If they recover fowls are quite liable to a return of the disease on the approach of autumn and winter weather; generally, a dose of pepper and a little rhubarb relieves them. Roupy fowls are very apt with me to be lousey. Keep off the lice, feed generously, supply plenty of absolutely pure water, lime, ashes, or dust, gravel, bones, shells, &c., and a dry airy roost free from draughts, and roup and gapes will scarce ever molest your fowls.

Couch Grass.

Dr. James Johnson, Greenwich, Washington Co., N. Y.: "I find my farm covered with quack or couch grass. I have tried faithfully to uproot this species of quackery, but like its congener, the more I disturb it the more it grows. Can the Farmers' Club inform me how I can readily exterminate the foul weed, or, what is better, how it may be utilized ?"

Mr. John G. Bergen said the only way to get rid of quack grass was by thorough and frequent cultivation. Several other members, however, declared that it could be thoroughly subdued by sowing the land with buckwheat two or three times a year and plowing the green crop.

Mr. S. Edwards Todd said that large fields of couch grass, commonly called quack, or quaking grass, are destroyed by plowing, harrowing and raking the soil in hot weather. The best way is to plow the ground deep in hot weather, and either summer fallow it, or sow peas, or buckwheat, or Indian corn, and after the crop has been removed in the fall, go over the ground every two weeks, till winter, with a cultivator or gang plow having sharp teeth, which will cut off all the grass about two inches below the surface of the ground. The next season plant Indian corn or summer fallow. If the work is done thoroughly, the extermination may be completed in two seasons. If the harrowing and cultivating is half performed, there will be as much grass at the end of two seasons as there was when the extermination first began.

Timothy—When to Cut.

Mr. J. W. Shepard, Penn Yan, N. Y., says his cattle "are unanimously in favor of all kinds of grass being cut before maturity. Is the verdict of this jury to be ignored because they are governed by unerring instinct rather than the frequently erring reason of man ? Why did my horses give this ripe hay a contemptuous toss

with the head, as much as to say, 'Don't you know that this stuff is about as palatable and suitable for horse feed as an ordinary brush-heap?' Why do the cows give it a smell and pass by on the other side in pursuit of something better, if it is already the most nutritious and suitable? Does the conversion of the succulent juices of the grass into woody fiber fit and prepare it for digestion and assimilation? If not, why should we let it mature because our fathers did so?" So far as we can judge, this is a question of appetite, not nutriment. We see daily evidence in the human family where appetite is gratified at the expense of health, nutrition, and economy. It is not quite certain that the instinct or reasoning faculties of dumb brutes teach them what kind of food to eat to promote the interests of their owners.

Mr. A. R. Goodrich, Centralia, Boone Co., Mo., gives a detailed statement of his experience in favor of not cutting timothy until fully ripe. He is sure that it then contains much more nutriment than when cut green.

Mr. T. A. Larzelere, Columbus, N. J.: "Timothy cut at that time you will find far softer and more desired by the horse than that cut two weeks earlier. Timothy cut before the blossom, for cows, is a great waste; it is exclusively a horse hay. Be kind enough to try and suggest the same to some of your trustworthy friends, and in time you will add millions by saving in your State, and the horse, if he could speak, would bless you."

Improved Roofing.

Mr. H. W. Johns exhibited specimens of his improved roofing. He employs a strong canvas as a foundation, which is well saturated with pine tar and afterward coated with durable water-proof material, composed mainly of gum of several kinds, which is not so offensive as the coal-tar cement roofing. The roof can be made white, if desirable. That color is eminently superior to a dark color for roofs, especially in the summer, as a dark-colored roof will absorb much more heat than one painted with a light color. The attic rooms of a dark-colored roof, in hot weather, will always be much more uncomfortable to the occupants than if the roof were painted white. On the same principle, shingles will not wear so long if painted black as when painted white or some light color, which will reflect a much larger proportion of the solar heat than black paint.

Breeding Dairy Cows.

Mr. S. Edwards Todd.—The first important step in securing cows having superior milking qualities, is to obtain a bull, the dam of which grand-dam and great grand-dam have been distinguished for their excellent milking qualities. Most farmers quite overlook the quality and pedigree of a bull, apparently thinking the sire can have but little influence in producing cows having those points well developed, which constitute superior milkers.

When it is known that the dam of a bull was an excellent dairy cow, and that she descended from cows that stood almost without a rival, for producing an abundant flow of milk, the most important step has been taken toward a radical and permanent improvement in dairy cows. If the bull is an inferior scrub or scalawag, he may be coupled with the very best cows that the country affords, and there will be no assurance that the product will make excellent cows. The next step in order will be, to select heifers from cows that are superior milkers. In making such a selection, the calf of an ill-formed cow should be rejected. If a cow have a large head, is heavy before, and has a bull's neck, she will be almost certain to be narrow behind, and contracted in the withers, with a small body, a small, ill-shapen udder, and very large or unusually small teats. Such a cow—and the country is full of them—will never breed a superior, first-class milker, either for the production of cheese or butter. The characteristics of an eligible cow for a breeder for dairy purposes should show a liberal infusion of some kind of improved stock—we care not whether it be Hereford, Alderney, Durham, Devon, or the stock said to be native breed—the cows of which are known to have been excellent milkers for several previous years. The form of the cow is of transcendent importance. She should have a small head and a lady-like neck, well cut up in the throat, with a little dewlap, broad and deep in the brisket, with a mild eye, unusually broad across the hips and pelvis, not very long-legged, nor having legs too short. The udder should be broad and of a symmetrical form, and not long and pendulous, like the nest of a Baltimore oriole. Cows with such udders are seldom first-class milkers. They should be broad in the pelvis and hips to insure greater ease and certainty of delivery at the time of parturition. Those cows that are narrow in the pelvis, if kept well, so that the fœtus attains a large size, will almost always experience extreme difficulty when calving; and they are often lost because they are too narrow in

the pelvis. A broad pelvis is an important consideration in selecting any kind of domestic animals for breeding. These brief hints will enable almost any farmer to begin this important undertaking this year, with the assurance of satisfactory success.

When to Cut Grass.

The question is raised every season, with regard to the best period in the growth of the grass, when, if it be mowed, it will make the best hay. All experienced and practical farmers agree that if it is desirable to have hay "spend well," or "go a good ways," it is better to allow the grass to remain uncut till the seed has matured. But if the object is to secure the greatest number of pounds of animal flesh, or milk and butter, the grass should be cut and cured when it is in full bloom. When grass is ripe it makes dry and less palatable hay than if it were cut before the blossoms had fallen. But if the grass is mowed before the seed has matured, the hay will be far more like green grass, than if it had been allowed to ripen, and animals will consume it with far greater avidity than if the stalks and leaves were dry and harsh. Every intelligent farmer knows that animals will thrive much better on green grass than on dry hay. Therefore, the nearer the hay can be secured, so as to make feed like grass, the greater the amount of nourishment a given quantity will afford to any kind of stock. When the grass is in blossom, the gum, starch and sugar are more abundant than they will be after the seed has matured. If a farmer desires to cut his grass when it will yield the most nourishment, it is by no means the best policy to allow it to become fully ripe, so that animals cannot consume so much as they would if the grass had been cut when in full blossom. The better way is to cut the grass when it will afford the largest quantity of nourishment, and then restrict every animal to a limited amount of fodder. If they need coarse fodder, containing a large quantity of woody fibre, let them have access to straw, and not allow grass that would make excellent feed to stand until a large portion of the nutritious matter has changed to woody fibre, which will afford very little if any nourishment. It is true that the riper the grass is when it is mowed, the less labor is required to cure it. But if the hay is designed for making milk, or for promoting the growth of young stock of any kind, or is to be fed to teams, the ripe hay will not afford so much nourishment as the green hay; and a ton of the ripe hay will last several days longer than if it

had been cut green, but will not yield so much nourishment. Those persons who want fat animals should cut their grass early; and if they prefer to have their stock poor, let them cut it late.

Adjourned.

June 26, 1866.

Mr. Nathan C. Ely in the chair; Mr. J. W. Chambers, Secretary.

City Garbage as a Fertilizer.

Dr. Thompson, Auburn, N. Y., addressed the club at some length upon the subject of using city garbage as the base of a most valuable fertilizer. In a sanitary point of view, he showed that such use of garbage would be of the greatest advantage to the city. He would have air-tight boxes set out upon the pavement in front of tenant houses, or where there is a large accumulation of garbage, with strict requirements to have every decaying substance placed therein, which could be perfectly deodorized and disinfected by a compound which is as follows: No. 1, as per "specification" contains by measure six parts gypsum, finely ground; two parts charcoal, prepared, coarsely granulated; two parts pure lime, fresh burned, finely ground; one part hard wood ashes; one part common salt. No. 2 will contain four parts gypsum; four parts charcoal; four parts lime. No. 3 will contain four parts charcoal; four parts lime.

The gypsum which the doctor has used in the preparation of this compound comes from the Cayuga beds, which contain a large proportion of native sulphur mingled with the rock in its formation, which increases its power as an oxydizing agent. The plaster is dried and finely ground in connection with the lime, which for this purpose should be burned and drawn hot from the kiln with the least possible exposure to the air during the process of grinding.

The charcoal should be prepared from the body-wood of the sugar maple, and burned in the earth-pit, by what is known as the "slow process," which chars the wood most perfectly, and at the same time preserves its porus structure. This charcoal is again recharred to drive off all gases; this is effected in cylinders in which the air may be admitted or excluded at pleasure, thus producing a purer and more efficient *sanitary charcoal* than by any other known apparatus. The charcoal thus prepared, is passed

through a mill so constructed as to granulate the coal with the least destruction of its capillary structure, thus increasing its power for the fixation of gases.

The portions of hard wood ashes and salt are mixed with the charcoal while being granulated; the three are then immediately mixed with the gypsum and lime, and packed in substantial barrels rendered air-tight by the application of a coating of plaster of paris *stucco*, on their inner surface.

With this cheap disinfecting material, which in itself is a good manure, Dr. Thompson thinks the whole garbage product of the city could be converted into one of the richest fertilizing materials; thus preventing a great waste, while the health of the city would be improved. The same material may be used for deodorizing privy vaults. Its value as a disinfectant has been highly recommended by some of the first chemical authorities in the country.

Dr. Edward R. Squibb, in a paper on Disinfectants, published in Med. Rec., May 15, says: "Freshly prepared lime and charcoal, in the proportion of about two parts lime and one charcoal, ground together into coarse powder, and the powder at once securely packed in barrels, would fulfill all the indications to the use of both agents, and would constitute as good a general agent for all the various uses in the form of a dry powder, as could be produced in the present state of knowledge, and if the community would accept the accumulated evidence of character and settle down upon the use of this, the greatest general good would be likely to result. Such compound might be appropriately called 'Calx Powder.'"

Privies deodorized with this material would only require to be cleaned in winter time, and then by a further addition of the deodorizer, the material could be barreled for the farmer's use. Dr. Thompson stated that the Lodi Manufacturing Company sells 80,000 bbls. per annum of poudrette, which is composed of a small quantity of the solid part of the privy contents and a large part of muck from the Newark salt meadows.

Cheap Paint for Farm Buildings and Fences.

Prof. S. D. Tillman.—Some questions having been asked the club about the best out-door paint, I would recommend as the cheapest and neatest covering for fence and rough work a mixture of lime paste and skimmed milk. The best preparation would be made by mixing lime with curd, and using milk or whey for diluting the

mixture. The reason why this compound will make a more permanent wash than ordinary whitewash is, that the coagulated casein in curd is dissolved in a solution of any alkaline earth, and the compound is not soluble in water. Glue can be mixed with a lime solution, but it will not resist the action of water, and it should not be used on surfaces exposed to rain. The oils which are used with metallic oxyds and salts to form paints are known as drying oils, because they have the power of abstracting oxygen from the air, and thu change from a semi-liquid to a solid. The most common drying oil is linseed. Hemp seed, poppy, sperm and cod-liver oil belong to the same class. Although common whale oil will not dry above the freezing point of water, a mixture of fish oils with ocher may be found a very cheap paint for barns and out-houses. For fine inside work the first coat of paint should be of white lead (carbonate of lead), which has great body; and a second coat, and all succeeding coats, should be of zinc oxyd, which makes a much whiter paint than lead, and is not discolored by sulphureted hydrogen, which sometimes taints the air. As a paint for iron and other metals the preference should be given to the oxyd of zinc, as the priming and the second coat should be applied before the first is entirely dry. In this way the common complaint about paint peeling off is entirely obviated.

Alum as a Wheat Fertilizer.

Prof. Tillman read a letter which gave a statement of experiments with various fertilizers upon wheat, showing that alum produced the greatest effect.

Fruit Preserver.

A new fruit preserver, patented by Mr. John J. Squire, was exhibited, which has some advantages over all other cans and jars, contrived for the purpose of preserving fruit in its natural condition. An elastic rubber gasket stops the passage under the lid, which is held in place by an elastic band around the neck of the jar, with loops strained up over knobs on the lid. There are also knobs upon the bottom of the jar to prevent its sitting close upon the bottom of the kettle, and being cracked. The jar is filled, and the lid permanently fixed before being placed in the water. There is a small hole through the lid which serves to let off steam, and is afterward closed by a cork, which facilitates the operation of canning.

Preservation of Fruits and Vegetables.

Mr. J. J. Squire read the following paper: "To provide for a store of fruits and vegetables for use in winter, as in their natural seasons, and in their natural condition, is becoming not only a necessity, but is a provident measure alike healthy as pleasurable. Nature has provided us a bountiful supply of the most delicious fruits that are limited to a very brief season. A variety of methods have been used to preserve these so as to extend their use to adorn our tables and gratify our appetites at any and every time desired. I need not cite the variety of these methods and their various merits, as they are sufficiently well known, and have more or less admirers, in proportion as they have been successful. These methods, however, have been attended with a risk and expense that have debarred their universal adoption, and have also failed to meet the most desirable ends. As our experiences increase, our tastes and demands increase in a like ratio; that which was once regarded as a delicacy and a pleasure, is now discarded or rejected as unfit for use, or unworthy our refined requirements. The one great aim in preserving fruits has been to retain their natural flavor and condition. In this, until quite recently, most, if not all, our efforts have failed. It has been the universal idea that sugar or other foreign means was necessary to this end—the reverse of which is actually the fact. I do not deny that fruits are and may be preserved by the use of sugar, &c., but I do deny that it is necessary; on the other hand, I venture the assertion that when so preserved the natural flavor and condition is more or less impaired or destroyed, and in the light of economy is quite objectionable."

To preserve fruit, &c., and retain their natural flavor, various means have been tried, but, as yet, two only have been successful, and but one thoroughly practical or convenient for domestic practice. It has been attempted to preserve fruits and vegetables by placing them in rooms or cases from which all air was pumped or extracted, and for a short time it was thought to be a success. In outline the fruit seemed perfect, but on being used it was discovered that the flavor was entirely gone. A mere pulp having no taste or flavor was the result. Others have placed fruits in cellars or houses, so constructed as to exclude all circulation of air, and lowering the temperature so as to preclude decay or decomposition. This has been more successful, but only practical where large quantities are needed, involving large capital in the investment;

and even in this, I believe, little or no success has been attained in preserving the more delicate fruits, whose lives, so to speak, are naturally brief and confined to the season of their maturity. Had there been any success in their preservation, it could not have extended beyond the preserving room, for as soon as exposed to a higher temperature the loss by decay or decomposition being so rapid, all profit became impaired. This method failing, because in the matters of economy and convenience impracticable, it follows that to be successful other means must be used. The end to be accomplished necessarily required chemical science, combined with mechanical application. Chemical, in order to expel those elements or properties, producing or assisting fermentation or decomposition. Mechanical, that when these elements are expelled to protect from further contact and union. In furtherance of this object it was found that heating or cooking accomplished the first, and the use of a jar or can the second. The fruit jar or can is therefore a necessary article of domestic economy, and these have been produced in every conceiveable construction and of almost every kind of material—all having some merit—many good in the hands of experts, but most being deficient in the general requirements for domestic use—in their ease and convenience of operation, and in their general excellence as perfect fruit preservers. The tin can, with soldered joint, has, perhaps, been the most successful, and perhaps more extensively used than any other, on account of the durability of the material and its adaptation to transportation. For domestic use, however, it is very objectionable, because it requires the aid of a tinman to solder them up, and the contents cannot be seen to know whether they are good or not; and again, tin imparts a flavor to the fruit, which to some tastes is objectionable if not offensive. Glass jars are preferable in this respect, but should be free from all metalic or other substance that would either impair the fruit or endanger the safety of the jar. The jar that is free from these objections, and in all other respects convenient for use, should be selected. A glass jar to be convenient, as well as secure, should have every requirement within itself and be properly made of good material and workmanship. The requirements necessary for a convenient and efficient fruit jar, are: 1st—A jar and cover wholly glass and capable of secure sealing, by atmospheric pressure. 2d—The cover should be secured by some fastening to provide against any undue action of the contents from improper preparation and cooking, and still provide for

the safety of the jar. 3d—It should be supplied with means of protection against breakage when used in cooking, and also transferring from a hot to a cold medium; and last, but not least, easily opened and capable of being used in succession, from year to year, without additional expense. Having a jar of this description in the Squire's Patent, all that is necessary is good fruit and pure water.

Our method is to select good sound and ripe fruit, prepare as we would to cook for present use; fill the jars as full of fruit as possible, (care being taken in this respect, fruit will then show well, and not be broken or crushed, as when cooked in a separate vessel, and afterwards conveyed to the jar), then add water to the fruit sufficient to cook, in proportion as the fruit is more or less juicy, after which place and secure the cover. (This being provided with a small vent, which allows for the escape of the steam and with it the air from the jar, as also providing a convenient means of filling up the jar with hot or boiling water, after the boiling is completed to the total exclusion of all air.) Then place the jar in a vessel of cold water and boil from 5 to 20 minutes, as per the following formula: After boiling we take from the vessel and allow the jars to stand from three to five minutes for the contents to settle, at the same time filling up with boiling water until the jars are quite full. At this stage we close the vent by a small cork which completes our work. When cold the jars should be placed in a cool dry place of even temperature.

Our formula for different fruits is as follows:

Raspberries, blackberries, gooseberries, cherries, currants, whortleberries and rhubarb, fill the jars full, add water so as to show from one-half to two-thirds full; boil from 5 to 10 minutes.

Apple, pear, pine-apple, peach and quince, require water added to show the jar two-thirds full, and to boil from 15 to 20 minutes.

Strawberries being very juicy require but little water, and should be reduced before securing cover. Fill the jars as full as possible without crushing the fruit, place in a vessel of cold water, heat up when reduced one-third of their bulk, remove from the vessel and empty every third jar into the other two, then secure the cover, replace in the vessel just removed from; boil for three or four minutes, then treat and fill up as directed for other fruits. The strawberries, best suited for preserving, we find to be in the following order: La Constant, McAvoy's seedling, Lady-Finger, Russell's prolific, &c.

Tomatoes—Scald and remove the skin; place in the jars; reduce and treat as directed for strawberries, boil from fifteen to twenty minutes; fill up and cork as for other fruits.

To preserve vegetables, it is absolutely important to take nothing but that which is fresh from the vine or stalk. If decay or withering is in the least commenced, success is impossible.

Corn—Strip from the cob; fill in the jars; add water to fill the jar two-thirds; secure the cover, and boil for five hours.

Beans and peas in like manner, boiled from two and a half to four hours.

Asparagus—Boil for thirty minutes. Using no sugar and cooking in the jar we economize expense, time, and labor, having no vessels to cleanse or auxiliaries to prepare. We also retain the natural flavor of our fruit, and can sugar to every variety of taste when required for use, as when prepared for the table in the season.

Hops—Statistics of Culture.

Mr. F. W. Collins, Rochester, N. Y: "Hop culture is with us still in its infancy, and yet the consequence which the subject is destined to attain in America is sufficiently obvious, when we compare the results already obtained here with the condition of this branch of farming in other countries. Austria, with 150,000 acres of hop gardens, seldom produces more than is demanded for home consumption. England has 60,000 acres devoted to hop culture, and yet cannot supply her own breweries. In both these countries hops are considered their best paying crop. America has at present only 18,000 acres devoted to this use, but if it is true that we can raise as good an article of hops, and obtain as large crops as Austria or England, is it not probable that hop culture is destined to become, if it is not already, one of our most profitable branches of farming? Ask an English hop-grower of the comparative merits of hops raised in the two countries, and he will claim superiority for the English hops, and make disparaging remarks upon the rankness and strength of American hops; but, on the other hand, ask the question of those whose opinion affects American farmers, the brewers and factors in England, and they will universally say they have found our hops richer in lupulin (the bitter principle) and in resinous gum than their own; that our hops are thirty per cent stronger than theirs, and as good to work up when a year old as are theirs when first picked. Our dry atmosphere

is much better adapted to the growth of the essential principle of hops than their moist climate.

"In regard to the yield per acre in England, as shown by official returns for the last twenty-three years that the excise duty was collected, there was an average of 6 cwt. 3 qrs. per acre each year. The highest average was 11 cwt., and the lowest 1 cwt. 2 qrs., and on this small yield they call hop-growing the best paying crop in England. It is unfortunate that our census report for 1860 does not report the average yield of hops per acre. It is believed to be from 8 cwt. to 10 cwt. per acre, and goes some years as high as 15 cwt. per acre in this country.

"The discovery of Dr. Samuel R. Percy, of New York, by which the value of the hop may be extracted and preserved without deterioration for any length of time, is likely to increase the market for hops in this country. Mr. Hawks' factory, in Rochester, N. Y., for condensing the extract of malt and hops is proving a success.

"After deciding that hop-growing is a subject of no secondary importance, the first question which arises is, 'How should they be grown, how secured?' for it is a notorious fact, that the profits of the crop may be increased ten-fold, or diminished in the same ratio accordingly as they are properly grown, carefully and seasonably picked, perfectly cured, neatly pressed, and the vines left in a condition to bear fruit the succeeding year, or extravagantly grown, carelessly or unseasonably picked, unsufficiently or over-dried, broken in pressing, or cut down and greatly weakened in the full vigor of their growth at the time of picking.

"Any soil which is suitable for corn may be used with advantage for a hop yard; and the same kind of manure necessary to prepare land for the largest yield of corn per acre is that best adapted to prepare the same for hops. Sub-soil plowing and under-draining are the first things necessary. No amount of after cultivation will atone for neglect of this primary step in the preparation of a hop yard. New land, especially that rich in vegetable mold, requires much less manure than old yards. When the soil is destitute of lime and magnesia, the use of lime, ashes, and bones is highly beneficial. The flour of bone, which can be procured in an unadulterated condition of the Boston Milling and Manufacturing Company, forms the most nutritive manure for many soils, restoring to them in a condition for immediate use the organic matter which the growth of hops so rapidly exhausts. Barnyard manure is generally applied every fall at the rate of a shovelfull to each hill, and the lime, ashes, or bone dust in the spring.

"The English Cluster and Grape hop are the varieties mos esteemed in market. The roots should be set eight feet apart each way. A free exposure to the sun and air is as necessary to the hop vine as to the grape. The common plan of training a mass of hops up a twenty or thirty foot pole is as detrimental to the perfect development of the fruit as would be the same method with the grape vine. The fruit-bearing arms, few of which are thrown out less than seven feet from the ground, need to hang freely in the air to do well. In the horizontal method of training hops four vines are allowed to run up a stake seven feet in height, when they are separated and trained upon twines stretched across the yard in both directions, by which means the fruit-bearing arms, hanging freely from the twines, receive all the light, heat and air requisite to ripen the fruit and prepare it for harvest several days earlier than hops grown by their side upon long poles. The twine used may be that known as wool twine or broom-makers' twine, either flax or hemp. The best way is for each hop-grower to raise a bed of flax and hire his twine spun. A man or boy upon horse-back, with a basket of twine fastened to a belt, should put the twine upon the stakes. Fastening it securely to the strong outside stake, he should ride along the row, winding it once around each stake, at the top, to the end of the row, where it is again secured. The same process is repeated for each row in both directions, and thus a net-work of twine is spread over the yard seven feet above the ground. Occasionally the hop-grower should ride through the yard and place the vines upon the strings. Standing with his back to the stake he should place the vine over the string with his right hand, and receive it underneath with his left—to let it grow with the sun, and it will show no tendency to leave the twine.

"The stakes may be either small round, split, or sawed, except the outside rows, which should be as strong as ordinary hop poles. They should be cut eight feet in length, and set one foot in the ground. The outside rows of stakes in each direction should be placed one row outside of the outer row of hop plants; this will prevent any crowding in the outer rows of the yard, and add much to the neatness of its appearance. Indeed, I do not know of anything more beautiful in the line of agricultnre, than a hop yard trained as thoroughly as it should be in this manner. That it is the most profitable crop a farmer çan raise does not prevent its also being the most attractive to an artistic eye.

"The saving in the expense of training a yard in this manner is

worthy of note. By the old method two poles, from fifteen to thirty feet in length, were necessary to each hill; by the horizontal method, one stake eight feet in length, with seventeen feet of twine, is all that is required. Several hundred stakes, eight feet in length, take the place of 1,400 expensive hop poles. Prices vary in different portions of the country, and yet the relative prices remain the same.

"In picking hops the universal practice has been to cut off the vine, raise the pole, and carry it with the vines to the box, leaving the roots to bleed freely. By this means the roots are all greatly weakened, and the stronger and most vigorous plants, if they survive the trial, prove the weakest plants the ensuing season. Canada thistles would scarcely survive the treatment, in this respect, which has most thoughtlessly been practiced upon hop vines. By using stakes and twine the necessity for cutting off the vine at the root is obviated. The box-tender, by the aid of a stool, if necessary, can reach every arm and cut it from the vine without injuring the vine that is left, and this secures a strong, vigorous plant for another year.

"It requires an experienced hand to manage every department in the cultivation and marketing of hops, and in none is more skill required than in curing them so as to preserve the color, flavor and texture without diminishing the strength. Hops that would otherwise turn out a prime article, are frequently spoiled in curing; either heating in the bale from not being sufficiently dried, or they are subjected to too great a degree of heat, and the aroma injured. If even a small portion of the hops are scorched the flavor is injured, and for this reason pipes should be used to distribute the heat evenly under the drying floor. The floor should be made of strips of plank one and one-half inches by two and one-half inches, set on edge one and one-half inches apart, covered with a floor cloth of linen or hair. The French kiln is much the best in use, as by that the hops can be dried evenly and rolled off into the cooling room without being broken. Hops should be neatly pressed. A good shaped bale of good hops, properly cured and pressed, as whole as possible, will always command a fancy price.

"The principal enemies with which the hop-grower has to contend are the mold and the blight caused by the aphis. The mold is a fungus that grows in the branches and stems of the hop, and often upon the bur, thickening the part affected, and preventing any further development. It has not yet appeared in American

hop yards, but has frequently injured the gardens in England, whose warm, damp atmosphere is peculiarly favorable to the growth of the minute plants which the mold reveals under the microscope. This disease is treated with an application of sulphur thrown on to the vines by means of a machine called a sulphurator; the fine flour is blown by a fanning mill among the leaves of the plant while covered with dew. Great quantities of sulphur are used in England for this purpose.

"The blight seen in hop yards is caused in the same way as that seen upon fruit trees, and sometimes upon rose bushes. Wherever the skin is grazed or pierced by insects, the sap escapes and hardens upon the surface. The only way to prevent this blight is to destroy the louse at its first appearance, which will be in July, by applications of a wash destructive to them. In England, where the blight has been known for sixty years, several remedies have been used with advantage. In Kent I have seen crops secured from gardens at the beginning of the season covered with lice, which had been exterminated by two applications of the following wash, thrown over the vines through a hose with a muzzle perforated with small holes, through a force-pump:

"A soap suds is made about as strong as is left from an ordinary washing. Into this is put salt and saltpeter to make it a weak brine. Dissolve copperas in warm water, and add to the brine in the proportion of one pound of copperas to five gallons of the liquor. Where the vines are trained low upon the horizontal plan, the expense of the apparatus, and labor of using it, as well as the waste of much of the liquid, is avoided, as a common large syringe answers the purpose equally well, and a man can go over a yard at an expense of one or two dollars per acre.

"Another wash, consisting of one pound coarse tobacco to one gallon boiling water, is used extensively in Kent, Eng. It is applied by means of a common large syringe. More boiling water is added when necessary to keep the wash at a proper consistency to be used in the syringe. This is an effectual remedy against every insect which it reaches, and a few applications at the proper season will insure a good crop where a total failure would be the certain result of neglect.

"In Canterbury, England, the receipt most used there for the blight, is one pound soft soap, called black soap, to four gallons water. Many use tobacco with the soap, but those who have had most experience say the soap and water alone are effective.

STRAWBERRIES—WHICH IS THE BEST?

Mr. C. Tabor says this question is quite as unsettled as it was a year ago. "None of the fancy sorts seem to increase in market. A few new kinds make their appearance every year, have a short run, and are then heard of no more. Triomphe de Gand, Union and Austin show less this year than last. The sort which made the greatest sensation a year or two ago, the Agriculturist, is scarcely to be found in market. Perhaps those who have this sort are growing plants for sale. They certainly do not grow fruit for market. The few offered look well, but marketmen say they are too soft to carry or keep well. The Triomphe de Gand loses ground every year. The fruit is good, appears well and sells well, but the plants are not reliable for a crop. Wilson's still takes the lead and comes out a long way ahead. Growers maintain there is more money in it than in any other variety. The Early Scarlet and Scotch Runners, small as they are, have paid well the present season. After all, it is a difficult matter to give advice about the varieties of strawberries, for a kind which does well in certain localities with one kind of culture, may fail entirely in another locality with different culture. Wilson's succeeds over wider range than any other. Upon the whole, growers differ about as much in their opinions as they did one year ago—some of them say they know less."

Geo. Perry & Son, Georgetown, Fairfield Co., Conn., exhibit Perry's Seedling, an accidental variety, which they have had five years. It looks and tastes much like the Wilson, and if better, we do not see wherein.

DURAND'S NEW SEEDLING STRAWBERRY.

The undersigned, appointed by the Farmers' Club of the American Institute a committee to examine and report upon the "Durand," a new seedling strawberry, respectfully report:

That your committee, after the adjournment of the Club on Tuesday, the 19th of June, repaired to Newark N. J., where we were met by Mr. Francis Brill, and conducted to his garden situated about one mile from the Market Street depot. There were also present Mr. Seth Boyden, the originator of the "Agriculturist" and "Green Prolific" strawberries, Mr. Durand, the originator of the strawberry we were called upon to examine, and Mr. John Brill, who for thirty years has been a successful horticulturist.

The "Durand" strawberry is a hermaphrodite, and said to be a hybrid of Green Prolific, Triomphe de Gand or Peabody's Seedling. These plants have been grown three years, and have not yet been offered to the public.

Your committee saw several large beds of this strawberry growing; some that were planted last fall were bearing fine fruit.

Although grown under unfavorable circumstances, your committee saw enough to convince them that this was a remarkable berry, and will add another to the catalogue of fine strawberries.

The fruit of this variety is large and firm, scarlet in color, and of fine flavor.

After visiting his extensive grounds, they were hospitably entertained by Mr. Brill, and the committee returned to the city well pleased with their trip.

The committee consisted of Messrs. Nathan C. Ely, John G. Bergen, Isaac T. Trimble, P. T. Quinn, S. Edwards Todd, J. S. Burgess, Wm. M. Doty, Wm. Ely Chilson, John D. Chism, John W. Chambers, Robert J. Dodge.

Grape Vines—How to Stop Bleeding.

Mr. J. B. Jones, Alleghany county, Pa., says: "A neighbor accidentally broke a grape vine. It bled profusely. He seared the wound with a red-hot iron, and stopped the bleeding immediately. From this I have learned a lesson. I have also tried it since, and find it effectual in stopping the vine from bleeding in every case.

Exterminating Weeds.

Mr. S. Edwards Todd.—July is one of the best months of the entire year for exterminating noxious weeds and bushes of any kind. If they are cut off near the surface of the ground, nature will make a desperate effort to reproduce another top, and the roots will spread but little until a new stem and leaves have attained a medium size, when the roots, if it is the habit of the plant to spread by the roots, will begin to push in every direction, and to send up new stems. This is particularly true with the Canada thistle. If the top is kept mowed off close to the ground, the roots will spread slowly, and in a few years, by simply mowing off the tops three times, during the growing season, the thistles will be so effectually subdued that in grass ground they will give but little trouble. There are many other kinds of weeds that farmers should mow off, cut up, or pull up, during the present

month. The horse-dock, in some portion of the country, has taken almost entire possession of the ground. The most effectual way to eradicate this noxious plant is, to cut off the tops close to the ground, and gather all the branches and panicles of seed into heaps, and after they have become dry burn them. When the young plants first appear, they should be pulled when the ground is wet. On many farms the borders of the fields are lined with a complete hedge of bull thistles, briers, shrubs and elder bushes, which root out all the grass, thus rendering the ground utterly worthless for anything useful. More than this, such belts of hedges and thorn bushes are a disfiguring blotch on the face of many fine farms, reflecting great discredit on the reputation of the proprietor as a neat and efficient manager. The most effectual way to exterminate such "eye sores" of the farm is, to remove the fence, cut down every bush even with the ground, and with a strong team turn the ground nicely over, six or eight inches deep, and sow about one bushel of buckwheat, or three bushels of peas and two bushels of oats mingled together, or four bushels of Indian corn. After which, let the entire ground be harrowed thoroughly three or four times. Such a severe pruning of roots and branches at this season of the year, will injure vegetation of any kind so seriously that but little labor next season will utterly exterminate the worst hedge on the farm.

Raising Root Crops.

Mr. S Edwards Todd.—As a general rule, American agriculture is not in a condition to make it pay to raise roots for feeding domestic animals. One reason for this fact is, farmers waste too large a proportion of their available manure. In other instances, they do not utilize the fertilizing materials that are available on many farms where roots cannot be raised profitably, because the soil has been too much impoverished by a long succession of exhausting crops. Roots of any kind, when the seed is not planted in a fertile virgin soil, require manure. Newly cleared land, in almost every portion of the country where there is not an excess of water in the soil, will produce a fair, and sometimes a bountiful crop of field turnips. But after such ground has yielded a few crops of cereal grain, it is seldom practicable to grow a crop of beets, turnips or carrots without first applying a liberal dressing of manure. At this season of the year, when the soil is fertile, a bountiful crop of turnips may be produced if the seed is put in

during the month of July. In many of the northern States barley, and sometimes wheat will be sufficiently ripe to harvest by the 20th of the month. Should the soil be only in a moderate state of fertility, by applying a good dressing of barnyard manure, and just before the ground is plowed, or by scattering commercial manure in the drills before planting the seed, if the ground is not exceedingly foul, a large crop of roots may be raised the present season. Sometimes farmers have been greatly deceived in regard to the crop of turnips when they have planted the seed in mellow, finely pulverized ground. Soil may be in a finely comminuted condition, and to appear at once capable of producing a bountiful crop of any kind of roots, yet if it be deficient in those elements of fertility which are essential to produce turnips or other roots, the crop will be a failure. Whether a person keeps only one cow, one horse, or fifty, during the winter, he should always have a good supply of roots to feed during the foddering season. Turnips, carrots, beets or potatoes are as essential in raising sheep, either for wool or mutton, as such roots are for neat cattle or horses.

Adjourned.

July 3, 1866.

Mr. Nathan C. Ely in the chair; John W. Chambers, Secretary.

Buckwheat in Hop Yards.

Mr. A. Bailey, Alps, Rensselaer county, N. Y.: "Last year, two of my hop-yards were devastated by the hop-louse. In those I sowed buckwheat as a preventive. I think it added to the trouble, for a third yard, without buckwheat, was not injured. In my case, the buckwheat was most certainly of no advantage. The same result happened with my neighbors.

Gas Lime.

Mr. F. R. Whitwell, Fair Haven, Conn., wants to know more than this club tells him about gas house lime. "Is there no book that treats upon it?"

Mr. Solon Robinson.—You will find it in many agricultural and chemical works, and encyclopedias. Everywhere you will find the same general information that we have given—that lime attracts sulphureted hydrogen and carbonic acid from the gas, which renders it unfit for manure, until it has been long exposed

to the atmosphere, unless it is applied to naked fallows, or such crops as will not be burned by its acidity.

A Plea for the Toads.

Dr. J. V. C. Smith read a most interesting and valuable paper for farmers, if they will heed its precepts, about the usefulness of toads, and an urgent plea for their protection. He made a beautiful allusion to an illustration of the designs of Providence, in forming the complete chain of animals, all of which have their purposes and usefulness. "It is idle to talk about useless animals. All are useful, and many that we despise, are necessary to man. Even the common house flies should be ranked among the best friends of man. All dead and decaying matter, which is most abundant in the hottest weather, is detrimental to human health and life. Swarms of flies rapidly convert this matter into living, healthy substance, and thus purify the atmosphere, and make our dwellings inhabitable. These ever busy workers are actually essential, particularly in the dirtiest portions of cities. They destroy immense quantities of pestilence-breeding impurities. Their busy motions pertain to life. With death comes foul odors, which flies consume and convert to life and motion. They are the real sanitary inspectors of our dwellings, and abaters of nuisance. They are under-estimated, and so are all reptiles. The despised toad is one of our most useful domestic animals—one of the farmer's and gardener's best friends. We should all teach lessons of useful instruction of the toad, and learn our children and servants never to injure them. They delight in well cultivated grounds, and live long in the same locality, occupying the same nests for many years. Their natural food is bugs and flies, which are injurious to the garden. They catch their prey with wonderful facility, by the power they have of shooting out their tongues, to the length of six or eight inches, striking with lightning quickness whatever comes within the focus of their two prominent eyes. If one eye is destroyed they lose the power of striking their prey. The tongue is covered with a glutinous substance, which holds every insect it strikes. Night is the toad's time to work. We have accounts of monster toads in Surinam, with mouths like a hog. All toads and frogs are insect eaters, and the numbers they destroy can hardly be over-estimated. They seem to have been predestined for the great work of destroying bugs and insects generally, and as the natural habitat of toads is

with man in his cultivated grounds, they are there his most useful co-workers. If not already in the garden, man should collect and carry them there. A few toads in a vine patch, soon rid it of its worst enemies, the bugs. The young of frogs, while in the tadpole age, breathe by gills, under water. After they lose their tails, and become perfect frogs, they are air breathing animals, and not amphibious. If they dive, it is only suspended inspiration. They must come to the surface to breathe. In spite of all that Shakespeare has said to sustain the prejudice against toads, they are not poisonous, nor hateful. Our antipathy all comes from faulty education. We should teach our children not to hate, but to protect toads. We should also try to overcome the prejudice against eating frogs. They should be the cheap and plenty food of the poor, instead of, as now, the choice dainties of the rich. They might as well be grown for food as chickens. Frogs would only need a fit place to live. They would need no food nor care. If the idea of cultivating frogs is thought absurd, it is not more so than the idea of sending ice to the tropics was thought to be a few years ago. It was made to pay, and a frog pond, as well as the ice pond may, and frogs should be an article of food in every market."

The paper of Dr. Smith, of which the above is only a brief sketch, was listended to with that kind of attention that proves its lessons were received with satisfaction, and several members related anecdotes and commendations of the toad. Prof. Nash recommended making toad houses in the garden, by placing four bricks together and covering so as to form little caves. Solon Robinson related an anecdote of one that the children learned to respect as "father's old toad."

The Ailanthus.

Mr. F. G. Skinner, New York, anathematizes the ailanthus tree. "Do, pray, at the next meeting of your club, bring this infernal Indian Upas to trial, and down with it. What plea can be put in mitigation of the sentence which I claim at your hands? Though an ardent lover of trees, I confess I can find none for this vile tree, which at this moment pollutes the air which I breathe, afflicting every member of my family with headache and nausea."

Mr. Solon Robinson.—I sympathize with you and your family, yet I cannot recommend the destruction of this tree, because it is the only one that can be depended upon to grow in our city pave-

ments. And although the odor of its blossoms be unpleasant for a short season, it does not harbor myriads of nauseous worms, and at all other times the tree is beautiful and beneficial. If you go for extermination, let it be only for that portion of the trees which blossom, as the others certainly are harmless. I would not recommend planting ailanthus trees near country houses, but I have earnestly urged people to plant them in many waste places, because they grow quickly, are ornamental, useful for shade, valuable for fuel and timber. Grown by the side of gardens, lawns or cultivated grounds, the sprouts are an unmitigated nuisance. The natural tendency of the tree seems to look back to the habitat in Asia, and grow up a jungle. We acknowledge that the odor of ailanthus blossoms is unpleasant; perhaps not more than one person in a hundred is affected by it in the manner described by our correspondent.

Prof. Nash.—Probably there are cases of persons who are really affected to nausea by the smell of ailanthus, but as a general thing I am satisfied that it is more the effect of imagination than reality. Some persons are affected unpleasantly by the smell of roses. Some people make a great outcry if they happen to smell the odor of a skunk, and where it comes very thick, it may be unpleasant, yet it is not unhealthy. It is fashionable to cry out against the ailanthus. If the odor was "far fetched and dear bought," as musk is, it would be just as pleasant. That makes some persons nauseated.

The Secretary.—By cutting back ailanthus once in three years, the whole effort of the tree is expended in making new wood, and it does not blossom. It would be a great pity to raise a prejudice against this tree, to destroy it, as it grows in the poorest soils, as well as pavements.

Pennsylvania Farming.

Mr. T. A. Bauer, Upper Allen, Cumberland county, Pa.: "I plow clover sod in autumn or March; and lime, 50 bushels to the acre, and plant with corn. This I harvest by cutting close to the ground, putting in shocks to cure. It is husked at the shocks, the stalks tied in bundles, hauled near the barn and stacked. In the spring, the corn stubble is plowed for oats. The oat stubble is dressed with barnyard manure, plowed and harrowed and left till it is time to sow wheat; then go over with a large cultivator, and afterward drill in the wheat. If intending to make the field into mowing land, I sow three pecks of timothy seed (per ten

acres) with the wheat, and in the spring one bushel of clover seed. Our farms in Cumberland county are generally so divided, that we have two parts for corn, two for oats, two for wheat, two for mowing, and one for pasture. This is our regular rotation. Our grass crops are heavy, and generally 40 to 50 bushels corn to the acre, 40 to 50 bushels oats, and 15 to 25 bushels wheat. My farm is clear of garlic and all other foul weeds, and hay and fodder are so plenty that I need not turn stock to pasture before the clover is in hand, and I never feed so close that I cannot turn down vegetable matter enough to produce a good crop of corn without any other manure. Still, we are careful to make all the manure possible, which we do by stabling our cattle the greater part of the year. We also stall feed many cattle, preferring to feed all the hay and fodder we make in the stables, using plenty of straw and oats for litter. The dung heaps from our stable enable us to give our wheat lands a heavy coat of manure every year. By plowing this in deep we have plenty of corn to sell and keep; and this is the way we keep our land in good condition, never exhausted, never in want of rest, never in a condition that will not produce a good crop. Land needs to be covered with a crop all the time; we do not think clover seed expensive; we can always make as much as we need and have some to sell. There is one thing the farmer must never forget in this course of farming; that is, to use lime as I have recommended, every year, upon one portion of the farm."

Mr. John G. Bergen.—Although I approve of the system of rotation in farming, and the growth of clover as a fertilizer, there are localities where it cannot be adopted to any extent, and where it is not a necessity. Such is the case among the market gardeners around New York. I know one field upon which cucumbers have been grown 35 years. All that is wanted is manure. Here the farmer cannot afford to wait its growth and decay in the soil ; he must buy it and apply it liberally.

Mr. P. T. Quinn.—I have cultivated land, without rest, steadily for sixteen years. I do not attempt to do so without manure. I cannot afford that. My land is better now than it was at first. I cannot afford to grow clover ; a crop of which is worth $30. I can buy manure and grow other crops more profitably.

When to Cut Clover.

Mr. D. Griffin, Nucker Springs, N. Y.: "Experience is a great test. Mine is in favor of cutting clover early. The earliest cut makes the best hay. By cutting clover early you give the second crop a chance to mature seed. Last winter the frost killed my old clover roots, but new ones grew from seed shelled upon the land, and grew thicker than before. Another field sowed in the chaff looks promising. It is not necessary for a farmer to have his clover seed cleaned, every one can grow his own seed."

Distribution of Seeds—Secretary's Report.

This shows a receipt, during the past year, of 11,616 applications—1,764 of them for bulbs, &c.; 8,320 for flower seeds; 1,532 for sweet corn. It has been impossible to supply this demand, notwithstanding the liberality of donors of seeds. Many letters still remain unanswered. They will be the first filled out of future supplies sent in for distribution.

Renovating Old Apple Trees.

Mr. S. Edward Todd.—In some instances apple trees become "hide-bound," so that the branches will grow but little or none at all, from year to year, and the trees will produce little or no good fruit. During the month of June or July, when the new wood is forming, all the old bark may be peeled off, from the ground to the limbs, and even above them, and a new, smooth and healthy bark will be formed over the entire body of the tree. If the tree is not too old, or if it has not been injured by being "hide-bound" too long, the effect of removing the old bark will be so salutary that the next season the tree will yield a fair crop of good fruit. We have seen trees treated in this manner with most satisfactory results. When the bark is removed, it is important to exercise care not to disturb the semi-fluid material that will make the new bark. If the bark will not peel easily, we may rest assured that the formation of new wood has advanced too far to admit the old bark to be removed. It is not at all probable, however, that a very old tree, the branches of which appear like dead brush, and are covered with moss, can be renovated and rendered productive, any more than it is possible to rejuvenate an old man who is sinking under the infirmities of age. If a tree were so old that a new circle of wood was not formed around the body annually, the safer way would be to simply scrape the body

and limbs, and haul a few wagon loads of rich earth and spread it beneath the tree, and spade or plow it in. In some instances it would be infinitely better to remove the tree root and branch, and transplant a young tree. We have known cherry trees and pear trees that had failed to bear for several years rendered eminently productive, by simply erecting a fence around them, as far as the branches extended, making numerous holes in the ground, dropping kernels of Indian corn into the holes, and confining a few swine in the yard, which would root the entire ground over and over and fertilize it with their droppings. This is an experiment that any one can try with safety to the tree. Rooting over the earth and manuring it may render the tree productive and it may not.

How to Build Privies.

Mr. S. Edward Todd.—One of the best ways to manage the fecal matter of privies is, to raise the privy up about eighteen inches higher than they usually stand; and instead of having a vault or cistern beneath the superstructure, place a water-tight chest made of inch boards beneath the seat of the privy. The chest or box should be about one foot deep and fourteen inches wide. The inside should be smeared liberally with coal tar. Four wooden handles may be secured to the corners, so that two men could handle it with ease. A pailful or more of water should be poured into the sink every day, as water is a cheap and most convenient deodorizer. Every day a few pounds of gypsum should be scattered over the contents of the sink, and then covered with a sprinkling of muck or garden mould. By this means the expense of making a deep costly vault, which is always a nuisance in hot weather, can be avoided, and several tons of the choicest quality of manure can be made by every family every season. By keeping water in the sink, and stirring up the contents every day, the offensive odor will all be retained in the water; and when the sink is half full, two men can remove it, and deposit the accumulation in a bed of muck, or directly in the garden, and cover it with earth.

Recess.—On motion the club adjourned to meet on the 4th day of September.

September 4, 1866.

Mr. Nathan C. Ely in the chair; Mr. John W. Chambers, Sec.

Mr. Wm. S. Carpenter.—I congratulate the members of the club that our sessions are resumed. The vast amount of information disseminated at these meeting have, no doubt, been of great benefit to the agricultural population of our country. I am gratified to find the Chairman occupying the post that he has filled with such satisfaction to the members of the club.

THE KITTATINNY BLACKBERRY.

The Chairman.—During the recess of the Farmers' Club, Mr. E. Williams, of Montclair, N. J., requested a committee from the club should be appointed to visit the fields of Kittatinny blackberries, at Newton, Sussex county, N. J., and report to the club in relation to the same.

The Chairman, in accordance with the above invitation, appointed the following committee:

Messrs. John G. Bergen, Wm. S. Carpenter, P. T. Quinn, S. Edwards Todd, R. J. Dodge, to which the Chairman, Mr. Nathan C. Ely, and the Secretary, Mr. John W. Chambers, were added.

This committee now respectfully reports: That on Thursday, the 2d day of August, your committee visited Newton, Sussex county, N. J., the place where this blackberry was first brought into notice. On our arrival we were agreeably disappointed to find some twenty-five of the most distinguished pomologists and small fruit cultivators had arrived there upon the same mission as your committee.

The history of this berry was furnished by the Rev. Mr. Pettit, who informed your committee that it was discovered about twenty years ago by a Mr. Wolverton, who found it growing wild in the woods near the Kittatinny mountains, in Warren county, N. J., who being struck with its good qualities, removed some of the plants to his garden, but gave them little thought or cultivation. They grew luxuriantly, and some five years later the Rev. Mr. Dunn obtained some plants and set them in the Rectory garden of Christ Church, Newton, but the berry claimed little attention until he, Mr. Pettit, succeeded Mr. Dunn as pastor, about eight years ago. Discovering their merits, he and Mr. G. H. Coursen, an enterprising farmer, began their cultivation, setting them in hills eight feet apart, and kept them free of weeds. The result was a heavy crop, and they decided to introduce the variety as something valuable. It was subsequently put into the hands of Mr. E.

Williams, of Montclair, N. J., a well known grower of small fruits for dissemination.

From the testimony of various gentlemen of the place, we understood that the berry is perfectly hardy and not subject to being winter killed; the last winter the thermometer at that place stood at from 16 to 20 degrees below zero for several days in succession.

On visiting the blackberry fields we found them in fine condition, the canes were stout and tall and loaded with very large ripe fruit. On testing them we found the flavor was very superior, and the berries free from cone. Ths berry was in market at Newton on the 18th day of July.

We have no hesitation in saying that we consider this berry one of the very best that has come under our observation, and recommend it to the notice of blackberry growers and amateurs.

In conclusion, we would remark that we were hospitably entertained at Newton, and on the evening of our arrival the Farmers' Club held a meeting in the large hall of the Anderson House, which was largely attended by the inhabitants of the town. At this meeting the merits of the Kittatinny and other new blackberries were discussed; also, the prospects of the fruit crop in the United States, the mildew on the grape, &c.

A full report of the meeting is herewith annexed.

NATHAN C. ELY,
P. T. QUINN,
JOHN G. BERGEN,
S. EDWARDS TODD,
R. J. DODGE,
JOHN W. CHAMBERS,
Committee.

New York, *August* 6, 1866.

The following report of the meeting in Sussex county appeared in the New York Tribune:

Kittatinny Blackberries.

Wednesday, *August* 1, 1866.—A committee of the Farmers' Club met in Sussex county, N. J., for the purpose of investigating the Kittatinny blackberry at its own home.

Starting from Hoboken at 4 P. M., a ride over the Morris and Essex Railroad through a broken and picturesque country, passing Newark, Orange, Morristown, Dover, Stanhope, etc., brought us

to Waterloo, where the train over the branch road to Newton was in waiting. Arrived at this latter place, and doing justice to a bountiful table furnished by the gentlemanly proprietors of the Anderson House, Messrs. J. & H. M. Ward, the blackberry in question forming a desert; the company collected in the hall above and organized by calling N. C. Ely, president of the club, to the chair, while the secretary, John W. Chambers, officiated in that capacity. The hall was well filled by citizens of the place, together with the investigating delegation of the following persons, viz.:

J. G. Bergen, Brooklyn; Dr. J. A. Warder, Cincinnati, Ohio; S. B. Parsons, Flushing, N. Y.; Wm. Parry, Cinnaminsin, N. J.; J. W. Chambers, Brooklyn; W. W. Conover, J. West, Middleton, N. J.; I. Buchanan, New York; D. D. Buchanan, Elizabeth, N. J.; E. Williams, R. T. Dodge, Montclair, N. J.; J. S. Eastmond, H. R. Smith, Port Monmouth, N. J.; N. C. Ely, W. J. Duncan, New York; J. Jelliff, M. Price, P. T. Quinn, Newark, N. J.; P. J. Ward, Bloomfield, N. J.; R. W. Holton, Haverstraw, N. Y.; J. H. Bowden, Freehold, N. J.; J. M. Johnson, Binghamton, N. Y.; J. S. Collins, T. S. Andrews, E. Roberts, Moorestown, N. J.; W. F. Bassett, Hammonton, N. J.; W. F. Cowdery, Sandusky, Ohio; J. C. Thompson, Staten Island; O. J. Weeks, Monroe county, N. Y., and the Tribune reporter, together with a few ladies.

After appropriate introductory remarks by the chair. Mr. Bergen moved that the subject of blackberries be taken up, as that was what we were so far from home to examine, and the Rev. N. Pettit was called upon for the history of the Kittatinny.

Mr. Pettit responded by saying, that about 20 years ago a Mr. Wolverton discovered it growing wild in the woods near the Kittatiny mountains in Warren county, N. J., and struck with its good qualities he set the plants in his garden, but gave them little thought or cultivation. They grew luxuriantly, and some five years later the Rev. Dr. Dunn came into possession of the place, procured some plants and set out in the garden of the rectory, but the berry in question claimed little attention until he, Mr. Pettit, succeeded Mr. Dunn as parson, about eight years ago. Discovering their merits, he and Mr. G. H. Coursen began their cultivation, setting them in hills eight feet apart, and kept down the weeds. The result was a heavy crop, and they decided to introduce the variety as something valuable. It was subsequently put into the hands of Mr. E. Williams of Montclair, for dissemination, and it is

at his request that a committee of the Farmers' Club should now pronounce upon it. In reply to numerous questions, Mr. Pettit said it was perfectly hardy, standing where the Lawton winter-killed, and is about a week earlier than that variety.

Mr. Kelsey of Newton, and Mr. Taber of Brooklyn, N. Y., both indorsed its hardiness, and spoke well of its productiveness and the good qualities of the fruit. Mr. K. called it as productive as the Lawton and with him of larger size. One great superiority of the Kittatinny was, that it is ripe when black, while with the Lawton only those which are just ready to drop are ripe and sweet, but pickers do not generally discriminate. It is fully a week earlier than the Lawton. In response to the coldness of the past winter, Mr. K. stated that the mercury fell 20° below zero, and that for days it ranged from 16° to 18°, killing the paper mulberry and the Isabella grape vines. The berry does not turn red by keeping. A fruit dealer of the place stated in reply to their keeping, that he could not keep them—they went off so quickly.

Mr. Williams called them a week early than the Lawton, and found they bore carriage and exposure well. He was sceptical at first, in view of praises frequently bestowed upon fruit about being put out. He examined the thing thoroughly, and at his first visit to inspect them, he picked fruit on Wednesday and carried it 60 miles to New York on that day. It was shown at the fruit growers' meeting the next day, and on Friday was still in good condition, with no change of color.

Dr. Smith said he had been purchasing the berries in market for a week, and it must be borne in mind that on their elevated ground, 900 feet above tide water, the season was nearly a week later than at Newark.

Mr. Williams said he was unwilling to be instrumental in foisting anything upon the public until well satisfied of its superior qualities, and to test the plant thoroughly on different soils and situations, he had given plants to various parties to report upon, some as far North as Michigan, and the accounts were entirely satisfactory; so last fall he decided to place them before the public.

Mr. Price grew the Kittatinny by the side of the Lawtons, and found the former bore one-fourth more than the latter—they could not hold more—and he gave decided preference to the Kittatinny.

Mr. J. C. Thompson, of Staten Island, said his Lawtons were badly cut down by the extreme cold weather last winter, and that he should not have one-fourth of a crop.

Mr. Bergen found his Lawtons very subject to being killed, but did not think the severity of the weather had much to do with it. The thermometer at his place at Long Island marked 10 a 12° below zero, which was the coldest for 30 years, but his Lawtons were not more killed than at some previous winters.

Col. Hamilton found his box and raspberries where the sun struck them in the morning killed worse than in other situations, hence some protection or break was needed.

Dr. Smith.—If cold is gradually drawn from a plant, the same as from frosted flesh, the injury will be much less than if suddenly extracted.

Mr. J. C. Thompson found his raspberries set on the north side of a fence much less winter-killed than those upon the south side.

Mr. S. B. Parsons said the same was true with conifers, which often killed worse in a sunny than shaded situation.

Mr. W. F. Cowdery—The seasons vary and wood ripens much better in some autumns than others. When well ripened it will stand the winter without killing badly. He bought one hundred of the Philadelphia raspberry and the next spring they were alive to the very tips, though the winter was severe. Last spring he found them cut down one-fourth or one-third, and can only account for it by imperfectly ripened wood. Grapes were badly damaged in Ohio the past winter, not so much on account of the severe weather as immature wood.

Dr. Warder said this subject of winter-killing was very important. Many plants will endure severe cold if they thaw gradually. Building fences upon the sunny side would be too expensive, but a partial protection is afforded by planting east and west between rows of apple trees, to be taken out when the plants interfere with the growth of the orchard—tall grass or sedge from the salt meadows, corn-stalks, etc., spread over the canes or vines afford them a good protection.

Some things are hard to explain. For example the purple cane-raspberry—the richest berry we have—and the black-cap, both reputed hardy, suffered badly last winter, while the Lawtons by their side, were scarcely touched. He accounts for it on the principle of self-protection, or the shade of plants upon themselves His new plants, with less shade were more injured. In reply to the question of cutting back, the Dr. nips his blackberries when breast high, or about the 4th of July. They branch out, and in

spring he nips the branches, as it will not do to let them bear all they would.

Recurring to the Kittatinny, William Parry, asked if that berry was one week earlier than Lawton, and held out longer, as was stated, if there was a time when we could get a good market picking. Said in picking it did not differ materially from the Lawton or New Rochelle.

Mr. Williams responded affirmatively.

Information was now called for concerning the Wilson's early, another new blackberry, which some present were cultivating largely.

Mr. Parry responded, that it was hardy and early. True the tips winter-killed a little in Burlington county, N. J., with the mercury 16° below zero. Had seen the Wilson bear double the crop of the Lawton along side.

Mr. Williams said it was an advantage for the tips to kill back, people were so adverse to clip them—nature comes in and does the work instead.

Mr. J. S. Collins, on being called out upon the Wilson's Early, said it was sweeter than the Lawton, though not as high flavored as the Kittatinny. Its size compares favorably with others. It was first found among the Jersey pines and set in a garden at Medford, where it gave a good crop of sweet fruit, but was little thought of for 10 or 15 years, and only within the past few years has it claimed much attention. It is safe to say it is a week earlier than Lawton, and ripens its fruit all at once, the right being over in two weeks from the first picking.

Mr. Williams said the Wilsons were early, productive and ripens their fruit in a body, which, for market purposes, makes them valuable.

Mr. S. B. Parsons asks about the cut-leaved blackberry, a late sort, ripening with peaches, which he considers valuable, and withal quite ornamental when trained as a hedge or upon poles. It is an enormous bearer, hardy, very large and sweet, but needs spurring. It is a French sort—Rubus laciniatus.

Dr. Warder has only seen it grown for ornament.

Mr. Quinn—It has the disadvantage of ripening at a period when people are tired of blackberries.

Mr. Parry—It will be confined to gardens of amateurs—a neighbor of his went into it largely, and finally offered a man 1,000

Dorchester plants to root out his cut-leaved sort, but even then failed to get them eradicated. It is too late to sell.

Mr. Parsons—We want something to eat as well as sell.

Mr. I. Buchanan does not like it, though it gives a good crop if attended to, spurred back and supported.

Exhausting the subject of blackberies the discussion turned upon the fruit prospects of the country.

Dr. Warder said the crop of fruit would be light in Ohio. He was of opinion that the cold weather in spring kept the insects from the blossoms at a time when they needed fertilization, hence the fruit did not set. In St. Louis the crop of apples would be large. Peaches were generally a failure. In Western Michigan and some other places they were fine.

Mr. Cowdery had been through Michigan, Ohio, New York and most of New England, had seen good peaches only in western New York. The past was a hard winter for grapes, the weather was unfavorable at the time of blossoming of the Catawaba; they were not well fertilized; still there will be as much fruit as the vines ought to bear, but the fine cluster will be wanting. Apples set well, but have fallen badly—did not see 100 trees in New England with full crops. Around Lake Erie they were fair, but light in central Ohio.

Mr. Williams thinks insects perform a more important part in the fertilization of fruits than we give them credit for.

Mr. Weeks, of Monroe county, N. Y., thinks there will not be half a crop of apples and peaches in that county. In some parts of the State the apples are good.

Mr. Cowderly saw good crops of pears in New England, but badly affected with blight in New York.

The Rev. Mr. Pettit—There are no peaches in South Jersey, with a pretty good crop in Maryland. North of Morristown, N. J., the trees did not blossom.

Mr. W. F. Bassett—The trees were mostly killed about Hammonton—few orchards look fair—what fruit set the curculio took.

Mr. Parsons has 60 acres peach trees on Toms River in New Jersep, and half if not three-fourths of them were killed last winter.

Mr. Parry—Peaches are an entire failure with us. The trees blossomed and set fruit, but there was not vigor enough to hold it. Apples are fine and pears full. They are now running the

early fruit into market. The early Joes (apples) are delicious and hang like ropes of onions.

Mr. Dodge—The peach trees look well, no curl as usual, but no fruit.

Mr. Bergen thinks that a good sign for a future crop. On Long Island the cherries were good, and this year there are some plums. Peaches are a failure. Pears promise finely. Early apples are good, late look bad.

Mr. Weeks—We have more plums than usual this season.

Mr. Quinn—There were no peach blossoms about Newark. Pears are above the average, though blight is showing itself. Apples are poor.

Mr. Parsons has three acres Delaware grapes on Long Island, looking well, with very little mildew.

Dr. Smith finds black spots on his Catawaba, which he was told was incipient rot.

Mr. Kelsey's grapes mildewed badly last season, save the Delaware, which escaped. The others were Catawba, Isabella and Diana; have seen no mildew this season, and they promise well.

Dr. Warder says mildew is a distinct disease, or a fungus growth on the leaves which causes them to fall. He was told by a friend that a heavy rain knocked all the leaves from his vines, but had to admit that the trees retained theirs. Mildew took them off. The upper side of the leaf turns brown, the under side white, The fruit turns black and falls when of the size of buck-shot; last year it showed itself early in June and the vines did not blossom. The mildew and rot are distinct diseases. With him the Clinton and Ives' seedling are about the only sorts exempt from rot.

Mr. N. C. Ely nursed the peach for years, in Connecticut, and what did not die he at last dug out. Apples are full; pears so abundant that he had been thinning many of them out, had removed thousands. Plums are doing nothing, but he is going to apply salt mud about his trees three or four inches deep; is told it is a remedy against curculio; has pruned at different seasons, but likes the summer best. One-half of an apple tree was pruned a few years ago in February, and the wounds are black with no wood over them. The other half, pruned in summer, healed over in two years.

Dr. Warder had seen one good thing in Jersey, and that was the apple worm preventive of Dr. Trimble, viz.: hay ropes wound

a few times around the trunk of the tree. He saw a band removed from a tree at Newark, and found about 200 of the insects which had secreted themselves to undergo the change to millers. It is satisfactorily proved that many worms leave the fruit before it falls, and crawling down the trunk secure a lodgment under these bonds, where they can easily be killed.

THURSDAY, *Aug.* 2.—The club was up betimes, and after strolling about and getting some magnificent prospects from the surrounding hills, and an equally magnificent breakfast at the hotel, started for the blackberry patch, first providing baskets, to test the *carrying* properties of the fruit. Arrived at Mr. Coursen's, and tested his home-made wine. The blackerries were soon reached, a glimpse of which showed that Mr. Williams hazarded nothing in offering them for inspection. The canes were strong and tall—too high for profit—and loaded down with very large, ripe and sweet fruit. In size it was fully equal to the Lawton—larger than we usually see that variety—more in shape of the long, wild sort, of honeyed sweetness, no core, and the seeds less conspicious than in the Lawton; but we must allow the committee to speak of these particulars. Suffice it to say that, spending an industrious hour among them, who left the canes less burthened, and returned to the hotel, where, after dining, an organization was again had, at which the following were unanimously passed:

Resolved, That having this day, August 2, visited the fields of the Kittatinny blackberry in cultivation at Newton, N. J., and tested the fruit now in perfection, we deem it due both to Mr. Williams of Montclair, and the horticultural public, to state that we regard this new variety recently introduced by Mr. Williams, worthy of unqualified praise. The hardiness, vigor, and productiveness of the plant, and the size and unsurpassed flavor of the fruit seem to leave nothing further to be desired in a blackberry ripening at this period of the summer, both for private gardens and for market. Also,

Resolved, That the thanks of this gathering of horticulturists be tendered to E. Williams and Mr. Coursen for their candor, kindness and courtesy in aiding the prosecution of our investigation, and also to the citizens of Newton for the interest they have manifested and the attentions they have shown us. Also,

Resolved, That our consideration and thanks are sincerely due and are hereby heartly tendered to J. and H. M. Ward, the proproprietors of the Anderson House, Newton, for their attentions

and for the excellent manner in which they have catered to our comfort and pleasure.

The above was appropriately responded to by the Rev. Mr. Pettit, and Mr. Kelsey on behalf of the citizens, who considered themselves honored with a delegation of such noted horticulturists laboring to disseminate useful and trustworthy information.

Mr. Ely spoke of the influence the club was exerting through its meetings and the reports, spread over the length and breadth of the land. He alluded to the sending abroad of 30,000 packages of seeds by mail during the past spring, the fruits and flowers of which would spring up by many a cottage. The streams eminating from here go out in numerous rills and carry a good, kindly influence to many a hearth-stone.

On motion, the action of the committee was approved, and the report accepted and adopted.

Fruits on Exhibition.

Mr. E. Williams and the Chairman had a few varieties, but the great show upon the tables was made by Mr. Wm. S. Carpenter, who exhibited 20 sorts of pears, and 29 sorts of apples, now in season upon his farm in Westchester county. Among those which he spoke of and particularly commended, of pears, we notice Duchesse de Berry d' Eté, which ripens the last of August, is very melting, juicy, and of pleasant flavor. Size, rather small. The Abbott, Mr. C. considers one of our best native pears. It originated at Providence, R. I. The tree, is a vigorous grower; fruit, medium size; beautiful and sweet. Kirtland's Beurré is an excellent pear, but requires skill with knowledge of its character to appreciate its goodness. The fruit begins to fall from the tree about the 1st of September, and decays almost immediately, or if eaten before decayed, it would be found dry and not excellent. If picked early and ripened in the house it is melting, juicy, sweet, aromatic, delicious. Beurré Clairgeau is one of the most profitable market pears grown in this vicinity. The Leggett, a native of Westchester, is one of the best in the collection of about 100 sorts grown by Mr. Carpenter.

Of apples, he finds the Porter one of the most profitable. It is appreciated by all persons. Hawley and Gravenstein are also excellent and profitable. The Vermont Beauty and Vermont Strawberry are both promising. New Jersey Sweet is one of the best sweet sorts, although the Golden Sweet is also excellent.

Mr. C. estimates the apple crop of Westchester county at not over one-eighth a full yield.

Mr. Solon Robinson said that in a long journey through New York, Pennsylvania, and New Jersey, he only saw apples in tolerable abundance at one point, and that was in the Wyoming Valley.

Mr. Disturnell said in a journey of 3,000 miles he only found apples plentiful in central Ohio.

Mr. P. T. Quinn congratulated the club upon the present exhibition of fruit, and hoped it would be continued every week through the season. He promised to do his part, and suggested that others might profitably bring in specimens for exhibition or for naming. Such fruit shows promote improved cultivation.

A New Use for Quinces.

Mr. H. A. Graeff, Brooklyn, exhibited a specimen of Cydonia Bitters, prepared by him from quince wine, which is certified by several medical gentlemen to be one of the very best tonics known in their practice. It is certainly free from all the nauseous properties which some bitter preparations possess. At the request of Mr. Graeff, a committee was appointed of several scientific gentlemen to examine and report upon the value of this new preparation.

Wooden-Soled Shoes for Farmers.

Mr. S. P. Shaw, Exmouth place, 118 Oxford Roads, Manchester, England : "I saw in the report of the proceedings of the Farmers' Club, a statement that the German wooden shoe was found serviceable to farmers working in wet places. Without doubt they are, but I think the Lancastershire 'clog' is far preferable, and I have sent a pair, and also a pair of 'patterns,' such as are worn by women when going out of doors into wet places ; they are much worn."

These shoes are made of leather uppers nailed upon wooden soles. The soles of the shoes are shod with a narrow rim of iron. The patterns are slippers of the Turkish form, that is, without upper leather around the heels. They must be very convenient for women to slip on when obliged to go a short distance in wet weather. A pair of American wooden-soled shoes was also exhibited, which Professor Tillman thinks altogether preferable to the English, because they are made with wooden heels and a wooden

sole under the forward part of the wood, having leather between which makes the sole flexible. A few of this kind were furnished some New Jersey soldiers in the late war, who approved them so highly that a large manufactory has been started in Newark.

Carbolic Acid.

Mr. George Bartlett exhibited and made some remarks upon the value of carbolic acid, which is a new product obtained from the distillation of coal, and has been proved the best disinfectant ever discovered. With that and sulphurous acid, cholera has been entirely controlled the present season in this city, and with it the rinderpest has been almost subdued in England. Its power as an antiseptic is almost miraculous.

Professor Tillman indorsed all that had been or could be said in favor of this substance, but he would prefer to adopt the name of phenic acid, whenever it is sold in liquid form, or phenol when in a crystalized form. At present, the retail price, $6 a pound, will prevent the general use of this substance as a disinfectant, although a pound will go a great way when properly diluted.

Successful Wheat Growing.

Mr. Wallace Sigerson, St. Louis, Mo., says that "Mr. Bamber, whose farm is 28 miles below here, in Illinois, sold his crop of wheat from 30 acres for $3,500. Average yield, 33¼ bushels per acre. St. Louis is the center of the best wheat region in the United States. The whole region can be made to average forty bushels per acre. But fruit-growing is more profitable than wheat. The Leonard grape has yielded $1,000 an acre. The soil of the American bottom is inexhaustible. It has been cultivated without manure over a hundred years, and portions of it are still for sale at very low rates considering its value."

Blackberries—Transplanting Wild Ones.

Mr. John E. Ennis, Lyons, Iowa, "wants to know if common wild blackberries will bear transplanting to the garden."

Mr. Solon Robinson—Yes, with perfect success. The Lawton, the Kittatinny, the Dorchester, the Wilson Early, have all been thus transplanted and improved. Plant them in rich, mellow ground, mulched with barnyard manure.

STRAWBERRIES.

Mr. T. W. Ross, N. J., asks: "Can the Wilson's Albany Strawberry be distinguished from any and all other varieties? If so, what are the distinguishing characteristics?"

Mr. Solon Robinson—The only way for you to learn is by careful personal examination of different varieties, which will enable you to distinguish them as readily as you can tell red apples from white ones. "Wilson's Seedling" and "Wilson's Albany" are the same, and easily distinguished from most other sorts.

PROPAGATION OF PANSIES.

Mrs. Merritt, South Haven, Michigan, sends the following, which she proved successful: "The soil should be a light, rich compost, made up of rich maiden earth, well rotted cow manure, and leaf mold; a little sand, if the compost is a little stiff. When the bed is prepared it should be watered through a fine rose. The cuttings should be taken from short-jointed, unbloomed shoots, from the center or side of the plants. Cut close under a joint, and do not use old shoots. Take off the lower leaves. Insert the cuttings in the soil, and press the earth firmly around them, water, shade from the sun, and when they begin to grow pinch off the tops of the shoots to encourage their making strong and bushy plants. Spring is the best time for propagating.

TESTING SEEDS.

Mr. E. Humphrey, Shamong, N. J.—"I tested sorgo seed this year by soaking in hot water, intending to plant only the heaviest, but being short of seed, planted that also which floated. It has made only about half the growth made by the heavy seed." It is not enough that seeds should merely grow, they should have power to give life and vigor to the young plants.

FISH.

Mr. Frank Pierce, Coventry, Chenango county, N. Y., "wishes to know how to keep small fish alive without changing the water often." Simply by keeping them in a stream of fresh water. Isn't that perfectly obvious.

Prof. Tillman—If aquatic plants are grown in water, it obviates the necessity of changing the water as often as would otherwise be necessary. The water may also be ærated by machinery.

Mr. George Bartlett said that was the mode practiced in the

great aquarium of Barnum's museum. Without some such plan for keeping water pure, it must be changed often, or it will not keep fish alive.

Potato-Bug Remedy.

Mr. Robert W. Clay, Olney, Ill., says the best way to get rid of potato bugs is to make blazing fires in the field every dark night, during the time the bugs infest the vines, going through the field at the same time and striking the vines to make the bugs fly.

Adjourned.

September 11, 1866.

Mr. Nathan C. Ely in the chair; Mr. John W. Chambers, Sec'y.

Exhibition of Choice Pears.

The Chairman—We have a choice collection of pears on the table to-day from Mr. P. T. Quinn, of Newark, N. J., and called upon Mr. Quinn to make some remarks upon their character, and profits of cultivation.

Mr. Quinn—In exhibiting these pears I have selected the varieties that are generally known. I have not included in these any new varieties. I will commence with the Duchesse d'Angoulême, because with me it has proved the most profitable. When perfectly ripened, it is delicious, and its great size is much in its favor. Specimens often weigh a pound, sometimes more. It does best on quince, is a strong grower, and prolific. Here is the Beurré Clairgeau, another very profitable market variety. The tree is vigorous and naturally of pyramidal form. The fruit is large, attractively colored, yellow, fawn and crimson, with russet dots; ripe in October and November, and I have sold them at $12 a bushel, and as the tree yields well, this is very profitable. Here is the Andrews, a very choice variety for family use, but as it does not bear handling well, it is not so valuable for market; but it is a pear that I would recommend for every private collection. It is an American seedling, of excellent flavor, large size; skin smooth and rather thick; pale yellowish green, with dull red cheek. The flesh is greenish white and full of juice. Its fault is rotting at the core. The Bonne de Zee is an excellent August pear, very sweet, productive, profitable; fruit large; light yellowish green, with russet patches; flesh white and juicy. The tree

is vigorous and productive, but apt to crack. This is the Doyenné Boussock, which is an excellent pear for an amateur; size large; deep yellow, clouded with russet, blushed; flesh, melting, sweet and aromatic. The tree grows strong, and is a profuse bearer. The Beurré Superfin has been much lauded; but I really cannot say much in its favor. The tree is very vigorous and productive, and fruit large and fine looking, but it is not first quality; ripens November and December. The Louise Bonne de Jersey is one of the most profitable varieties grown for market. It bears well, keeps well, sells well. Tree is vigorous; fruit large, and of handsome form, and comes into market directly after the Bartlett, and I rate it as first class. Beurré Diel (so called after an individual of that name) is in every respect first rate, and a very profitable market pear; though in some situations it cracks, it does not upon our soil. The tree is vigorous and productive, and fruit large; orange yellow when fully ripened. The Belle Lucrative is not attractive, and not well known in market, and therefore does not sell well, although it is one of the best autumn pears known. It is always good, and gives satisfaction to those who eat it, and by many considered equal to the Seckel. It should be in every private collection. The tree bears beyond any other; the fruits hangs in clusters like ropes of onions; is of medium size; pale yellowish green. The Sheldon, an American seedling, will yet make a great mark in the world. It should be one of the leading varieties cultivated everywhere for market. The fruit is medium size; yellowish green; very hard; bears handling; ripens in October. Seckel is too well known, perhaps, to need description. It is among the smallest sized pears grown; is a native American originated on the farm of Mr. Seckel near Philadelphia. It is without doubt the most excellent variety known. The Urbaniste is a late autumn or winter pear; medium size, though about one-half run too small for sale. I do not find it a profitable variety to grow for market, as it does not sell well. Onondaga, or Swan's Orange, supposed to have originated at Farmington, Conn., is of large size; coarse yellow skin, dotted with russet, sometimes blushed; flesh buttery and rich, when in perfection. It is a fruit of which you are never quite certain, as it is often acid and not rich. If left too long on the tree it rots at the core. The winter Nelis has few equals from January to March. It is what I call a very good quality of winter pear, and the tree is a free bearer. Now here is the Vicar of Winkfield, which has a character which

may be set down as good, bad or indifferent, according to the opinion of cultivators. The tree requires age before it comes into bearing, then it is productive and profitable to sell at $5 a barrel, at which the fruit sells readily in this market in autumn for cooking purposes, and many persons who use it do not know that it could be ripened at a high temperature into an excellent winter fruit. The Vicar is a good tree to work other varieties upon. The Bartlett is too well known for its excellence to need description. It is very popular, and comes directly after peaches, and sometimes in such abundance as not to be profitable to the grower. It was a drug a few days ago, now it is worth $16 or $18 per barrel. The Flemish Beauty does not give satisfaction with me, as it only sells for $5 per barrel, when Bartletts are worth $15. It is because it is not well known to New Yorkers. In Boston it is a leading and profitable variety. There they know its value. It grows a superb tree, very luxuriant and prolific. The fruit requires to be picked early and ripened in the house. The Tyson is another excellent native, originating near Philadelphia. The tree is an upright, vigorous grower, but tardy bearer, though eventually very productive. The fruit is medium size ; deep yellow, with crimson cheek, which gives it an attractive appearance. It bears well, and if it has not the highest quality, has one that makes it valuable ; it hangs long on the tree. Here is a pear which is good to exercise the grower's patience. This is the eighth specimen which I have had from a tree twelve years old. It is called St. Michael Archangel. Although we are willing to wait long for the coming of that personage, waiting twelve years for a crop is rather too much for the patience and profit of a market gardener.

Mr. Quinn was asked what five pears he would grow that would be most profitable for the New York market.

Mr. Quinn said, for his situation, he should name the Duchesse, Bartlett, Sheldon, Lawrence, Seckel, as the five most profitable pears to grow for the New York market. If he could have only five for family use, he would name Bartlett, Flemish Beauty, Duchesse, Beurré L'Anjou, and Belle Lucrative.

After this interesting description, Mr. Quinn directed the fruit to be distributed among the members of the club.

SORGHUM JUICE EVAPORATOR AND REFINER.

Mr. Ward Holmes, Rockford, Ill., called the attention of the club to Youngman's Evaporator and Refiner, and claimed for it many points of excellence which Sorghum growers will appreciate. He also said that the culture of sorghum sugar cane, for the manufacture of sugars and syrups, has justly grown into great popularity. Since the general growth of sorghum in the Northern States, millions of dollars have been saved to consumers which otherwise would have been expended for foreign and Southern products.

This new addition to Northern products has involved the necessity of new machinery adapted to the manufacture of the juice of the cane into syrups and sugars. This new machinery has but partially answered the required purpose. The very best of their results has been but little better than the simple evaporation of so much of the water contained in the cane juice as would leave a syrup of the requisite consistency for common molasses. But the molasses so produced has invariably contained a peculiarly unpleasant and objectionable flavor, which has made the syrup not only unpalatable to ordinary taste, but unmarketable, except at a rate below the common New Orleans molasses. On this account some cultivators have felt somewhat discouraged in prosecuting the growth of sorghum for the manufacture of syrup. And but for the rapid development of the productions of the northwest, and the necessity of providing cheaper sweetening than could be imported, the culture of sorghum would very likely have been suffered to decrease.

Prof. Tillman—I do not approve of this portable apparatus. As an evaporator it may possess some advantages over others, which are worthy the attention of sorghum growers; if so it is important, for every improvement which facilitates the production of seccharum is an advantage to the public health; but to be successful with sorghum juice we must not depend upon locomotive machinery. The business requires something more permanent and substantial.

GAS LIME—HOW TO UTILIZE.

Prof. Tillman read a communication from J. Burrows Hyde, New York, detailing a method for utilizing gas-lime. Mr. Hyde says: "I propose to pulverize or granulate dry peaty matter—which, in that state, rapidly absorbs and fastens sulphuretted

hydrogen, and other feted gases in great volume. Provide upon wheels boxes of about one cubic yard contents, and arranged to be easily emptied ; one of which boxes fill with the prepared peaty matter, and place one or more of each along side of the purifying chest. The chest being opened, empty the contents sieve by sieve into the empty box, an attendant standing by the peat and throwing over the lime from each sieve about an equal quantity of the peat, until the box is full, when it is removed to the place of deposit, and another subsituted in its stead. The work of opening the chest and removing its contents should be as expeditious as possible, for which reason it will be well if the chest be so placed that it can be worked on each of its four sides. To render this process complete and most efficient, a grinding mill should be used convenient to the works, and to which mill the mixture should be conveyed in the boxes and dumped over the hopper. The mill is for the purpose of thoroughly and quickly incorporating the lime in uniform fineness by breaking up all lumps. From the mill the mixture should be placed in barrels and headed up for sale. By this operation there will be a very slight escape of gas, and then for only a brief interval, and a valuable mixture is obtained, which will not only serve in a great degree to meet the expense of the lime to the gas companies, but will preserve for agricultural use a valuable commodity now absolutely wasted."

Peat—its Uses and Cost of Manufacture—its Value as Fuel for Farmers.

Mr. Solon Robinson submitted an article upon the subject of Peat which he said had given rise to a great deal of inquiry, and had already convinced some farmers that lands which they had heretofore considered worthless were the most valuable they possess. Mr. Robinson asked to have the article submitted to a committee to inquire whether it was not worthy of being incorporated into the volume which contains the reports of this club.

In the same connection he read a letter from Mr. Delos Dunton, Pekin, Niagara county, N. Y., which details the "operations of Mr. S. Robert's Peat machine which you mention in your valuable article on Peat. I give you some details of the working of the machine, which is operated by three men and a boy, the latter moving the spreader, and one of the men acting as engineer and fireman, the other two digging the peat from the bog and placing it upon the elevator which carries it from the top of the mill where

it is manipulated, and discharges it through the spreader upon the ground to dry. The machine thus prepares peat as fast as two men can dig it. In one hour and a half I saw 750 superficial feet of ground spread with condensed peat six inches thick. A cubic foot of the condensed wet peat weighs twenty pounds when dried; and at the rate I saw it manufactured enough can be spread in one day to make twenty-five tuns of fuel. The cost would be: engineer, two dollars; shovelers, three dollars; boy, one dollar; fuel, two dollars; besides maintenance of machinery. Mr. Roberts estimates the total cost of condensing at fifty cents per ton; and haking and piling at fifty cents more. I think I have seen it demonstrated to-day that peat can be prepared ready for the stove with less labor than chopping, sawing and splitting wood. The engine is twenty-horse power and locomotive. Mr. Roberts expects to drive an excavator by the same engine that does the other work, and thus greatly cheapen fuel to farmers."

Mr. Jonathan Bundy, Springdale, Cedar county, Iowa, says: "The peat question is agitating the people of this State. I know of more than 500 acres discovered within the limits of six or seven counties, some of it 20 feet thick."

Blackberries.

Mr. Freeman Baker, Coventry, R. I.: "Will the large canes that come up from the ground this year bear fruit next year, and more than one year; if so, how many? Where many large canes come up from the same root, how many of them may be allowed to stand together?" Blackberries are always produced upon wood of the previous year's growth. Some old canes may throw out shoots which will be fruitful a second year. As a general rule, most of the canes which have borne fruit this year may be cut and burned as soon as the fruit is gathered. The new shoots should be stopped at four feet high, to induce them to send out the side shoots which bear fruit. You may let as many canes grow as you have room for, if your land is rich enough to bear them.

Mr. E. Smith, Pontiac, Mich.: "Blackberries are very abundant in this State distant from market. I have heard of condensing the juice, which I should like to do, if I understood the process. Can it be made to advantage on a small scale? Does it require much machinery and is there a patent right for it?"

Mr. Solon Robinson—The patentee is Gail Borden, Brewster,

Putnam county, New York. The juice of fruit is condensed in a vacuum pan, exactly as milk is condensed, or as the juice of beef is condensed; the latter at the rate of 33 pounds into one, which retains all the really valuable nutritious matter of the whole mass. A great many of the wild fruits could be condensed with profit to the manufacturer, and very great profit to consumers.

Agricultural Books.

Mr. J. Mason Reynolds, West Walworth, N. Y., asks: "Will you publish for the benefit of your rural readers a list of the most standard, suggestive, reliable and interesting works on agriculture; such as contain ample and various hints and information on all that pertains to the various branches of husbandry. It is plain, sound practical books that we want, those which contain earnest, original, well-authenticated facts, rather than profound science clothed in language farmers cannot understand. We want to know all about sheep, hens, horses, cows, swine, fruit and every department of horticulture and farming. Please indicate such books as would constitute a small library of good, sound, practical knowledge."

The advantages of making such a list, and the difficulties of making one, were pretty fully discussed, and the matter submitted to a committee who will give a report at a future meeting.

Taxidermy.

Harriet A. Higginson, Benson, Vt.—"I shall be greatly pleased if some member will give the instruction necessary for stuffing birds."

Mr. Solon Robinson—Skin the bird carefully, without cutting or tearing the skin, cutting off the heads and feet attached to the skin; scoop out as much as possible from the skull, and fill it and the lower cavities of the legs, and coat the flesh side of the skin with arsenical soap, a preparation of which you can buy at the druggists. This preserves all the animal tissues from decay. Then commence sewing up at the neck, and stuff as you go along with any fibrous substance most convenient, such as hair, wool, cotton, tow. The artificial eyes you must purchase.

Adjourned.

September 18, 1866.

Mr. Nathan C. Ely in the chair; Mr. John W. Chambers, Sec'y.

PEARS—CAUSE OF THEIR CRACKING.

The Chairman exhibited some specimens of pears from his farm at Norwalk, Connecticut, remarking at the same time that the skins had cracked very much this season, so as to render the fruit of several trees entirely worthless. He stated the soil to be a rich sandy loam dressed with muck, the pears all set on quince stock. Those which cracked the worst were of the Virgalieu, yet there is one tree of this sort subject apparantly to the same condition of the others, upon which the fruit is nearly or quite all perfect.

Mr. S. Edward Todd contended that the cause of cracking was a want of clay in the soil, and instanced several cases in Tompkins county, New York, where he dug and carted the top soil around pear trees and replaced it with clay, which he thought was a complete remedy, as the fruit which the trees previously bore cracked badly now became perfectly sound.

Mr. Smith, Westfield, Mass., who is an extensive pear grower at that place, contended that planting pear trees in clay soil or afterward adding clay to the soil would not prevent the trouble of cracking. He has frequently had fruit cracked one year and be sound the next on the same trees. A neighbor of his has a pear orchard on a stiff clay soil and his pears cracked badly. The same is common in the vicinity of Hartford, Conn., upon that red stiff clay. They never uniformly crack in any orchard be the soil what it will. One of my own trees which bore a heavy second crop last year, has scarcely a pear on it this year which is not cracked.

Dr. Langinschwartz said the cracking probably was caused by lice which prevail one year and do not another; they are most common in cold and wet seasons like the present. If you examine the fruit with the microscope you will find a line of very minute holes made by these insects which causes the skin to crack as the fruit increases in size.

Dr. Crowell said he had one of the most powerful microscopes in use, and had frequently examined without finding these insects.

Dr. J. C. V. Smith said he was a convert to the insect theory.

Prof. Tillman thought it was much more likely that the cracks

were occasioned by a deficiency in the soil of that material necessary to form the skin.

Mr. Todd suggested a cure of the disease by a liberal dressing of the ground with wood ashes.

Mr. Smith said that he had covered a portion of his orchard with the heaviest dressing he ever saw applied to any land, and although it amazingly promoted the growth of trees, it had no effect whatever in preventing the cracking of the fruit.

Lightning Rods.

The Chairman read a letter from Roseburg, Ohio, asking the opinion of the Club about the use of lightning-rods, and whether insurance companies usually make any difference in the rates of insurance upon buildings furnished with rods, and upon the whole, whether insurances are of any benefit to farmers?

The Chairman said that some country offices make a difference of five cents on the $100 in favor of buildings furnished with rods. No office in this city makes any difference. They do not, as a general thing, hold lightning-rods to be of any service. I do not, myself, consider it any less risk, particularly upon barns, where, as it is said, the steam from the hay often is more attractive than the best lightning-rod. The writer alludes to the fact that insurance companies have failed extensively. In this State all insurance companies are compelled by law to keep their capital in such a condition as to be a protection to those who are insured.

Mr. Adrian Bergen, a Long Island farmer, thought that farmers generally who had their buildings furnished with lightning-rods felt a much greater degree of protection than those which were not so furnished.

Prof. Tillman believed lightning-rods were a protection, if they are properly arranged.

Mr. Solon Robinson said he would as soon expect to turn a rifled cannon ball from its course with a piece of pointed iron, as a thunderbolt by a lightning-rod. He does not believe in the power of attraction of the most perfect points extending over ten feet, and the proper arrangement of a rod which Mr. Tillman speaks of would be to have such a number of bright points attached to the highest part of the building that every ten feet of space would be occupied. From these a continuous rod must extend down to the earth and into water, or else so deeply into the ground it always absolutely is moist. In that case it is highly

probable that electricity might be conducted from the roof to the ground. It is equally probable that in less than twelve months hence the bottom of the rods would become so rusty as absolutely to be a non-conductor.

When to cut Timothy.

Mr. Gilbert Martien, Ashland, Ohio, writes: "After an experience of over forty years, I am fully established in the opinion that the proper time to obtain the largest amount of good timothy hay for all stock, is when it has done blossoming. If cut when in head before blossoming, the juice is thin, watery and tasteless, and when cured the hay (what little you have) is a light drab color, in weight and nutriment about equal to oat straw. When in bloom the juice begins to assume a greenish color, and hay when cured, is of a bluish color, and is more nutritious, and has more bulk and weight. When just out of bloom, the stalks contain a rich green juice, the hay is easily cured, and retains nearly the same color as when cut, yields more hay than at any previous time, and better feed for horses, cattle and sheep. When further advanced toward maturity, say when the seed is beginning to ripen, we have more weight, and for horses I consider it most preferable."

How to Grow Grape Cuttings.

Mr. C. J. Pennoyer, Sharon Station, N. Y., writes: "I have been raising some grape vines the past two seasons from cuttings. I planted them in fall, deep, tied in bunches, left them till I thought all signs of frost were over, prepared my ground, then took up the cuttings, found them with sprouts some two inches in length. I placed them carefully in the ground with the sprouts above. I then gave them a good sprinkling, placed brush around them, and covered with old thin rag-carpet; kept the ground moist; when it was rainy removed the carpet, but last season used green hemlock boughs instead of carpet, and liked it better; raised some Iona and Rebecca in a pot with window glass over them; had fine roots; put them in the cellar last fall; set them in the ground in the spring; grew well; took off some cuttings last of July, placed them in a pot with glass over; found them rooted some two weeks since; one two year old Concord has a number of fine bunches of grapes, and one Delaware one small bunch. I

thought my experiments might be a benefit to some who wished to raise a few vines for their family use."

Fithian and Young's Rotary Cutting Plow or Earth Pulverizer.

Prof. Tillman, from the special committee to examine this machine, read the following report:

The undersigned, members of the committee appointed by the Club to witness the practical operation of the above named pulverizer, respectfully report:

On Friday, September 7th, they proceeded to the farm of Aaron Smith, near Bath, Long Island, and there found the machine ready for the trial on land from which potatoes had just been dug. That portion of the machine distinguished as the pulverizer, consists of a series of steel knives set spirally around a common axis, the back end of each knife being a little nearer the axis than the front. These knives are set on the cylinder in three moveable sections, each twelve inches broad, thus enabling the operator to cut 12, 24, 36 or 48 inches in width. The number of the sections used will depend on the weight and character of the soil and the number of horses to be employed. The pulverizer is connected by gearing with the driving wheel, which is of much larger diameter, and consists of a series of radial arms, on the extremities of which are two sets of iron-shod slats, forming the periphery; they are placed at an incline so as to form an obtuse angle at their points of contact in the middle of the face of the wheel, the object of the inventors being to strike the ground with these connected slats in such a way as to compress the soil against which they are acting, thus to a certain extent imitating the movement of a horse's foot, and obviating the evil of throwing up the soil always arising when these slats are placed directly across the wheel, (i. e.) at right angles to the radial arms. The machine is mounted on four wheels, which are used in going to and from the field; the one in operation weighed about 1,800 lbs., and was driven by four horses. Three sections of cutters or knives were used, the width of work done at once being three feet. When proceeding at the rate of two and a half miles per hour, the driving wheel makes nearly eighty-five revolutions per minute, the number of knive cuts into the soil during that number of revolutions of the large wheel, being 3,050.

The horses used at the trial had not been worked together

before, and moved at too rapid a rate—not less than three and a half miles per hour—yet they seemed to draw the machine with ease. The depth of cut was, on the average, from four to five inches; the machine is so arranged, however, as to graduate the cut to any depth, not exceeding eight inches. As to the quality of the work done, your committee can confidently say the soil was more completely pulverized and aerated than it could have been by any other means now known to them. It was evident that a large quantity of soil was finely divided and thrown up into the air constantly; the dust thus raised would have been annoying were not the knives covered by a hollow half cylinder of sheet-iron.

The breadth of land ready for the machine was too limited to admit of a very extended trial; your committee can only speak with certainty as to its action upon light sandy loam like that of the farm of Mr. Smith. They would desire to see it operate in heavy clay and in thoroughly wet soil. They hardly need state that the machine cannot be used on stony ground. As to the actual value of this mode of culture, nothing can be said with certainty until after ascertaining the yield of two fields of the same size lying side by side, one having been prepared for the seed by the old, and the other by the new method. Your committee will say, however, they are very favorably impressed with what they have seen thus far of the rotary pulverizer.

SAML. D. TILLMAN,
ABRAM BERGEN,
JNO. M. CROWELL.

NEW YORK, *Sept.* 18, 1866.

On motion, the report was accepted.

PRESERVING SWEET CORN.

Mr. R. H. Arnold, Honeoye, N. Y., says: "In preparing sweet corn for drying, its entire sweetness (much of which is lost by boiling it in water) may be retained by cutting it off raw, and putting it into a pan without water, and cooking it over a vessel of boiling water."

The Chairman gave it as his experience in preserving sweet corn the present season: Enough to fill two dozen glass jars was boiled for half an hour; it was put up, the air tight lids put on, and the jars put into a cool cellar. Before three days one-half of them had burst, some of them going off into reports like muskets.

The others were then emptied, and reboiled, and put up again, since which, six more have burst. The remainder has been boiled the third time, and it is even now doubtful whether it will keep. A friend has told him that the only way is to boil it fully two hours before canning. Adjourned.

September 25, 1866.

Mr. Nathan C. Ely in the Chair; John W. Chambers, Secretary.

Fruit Exhibition.

Mr. John Crane, Union, N. J., exhibited several varieties of pears, among which was the Columbian Virgalieu, of which he speaks in high terms, considering it the best winter pear that he grows. This opinion, however, has only recently been established. He planted a number of the trees as standards eighteen years ago, which, not having borne any fruit for ten or twelve years, he re-grafted all except one, which has now been bearing about five years, producing the fruit exhibited. The only objection to this variety is its liability to drop from the trees before it is ripe. To prevent this, the tree should be set in places well sheltered from the wind.

The Beurré Bosc, Mr. Crane esteems highly for his dry, warm soil. The specimen of Henkel which he exhibited was not as fine flavored as this variety usually is. When fully ripened, in October, it is highly perfumed, although the flesh is considered rather coarse. Specimens of the Abbott were very beautiful. This pear originated upon the farm of Mrs. Abbott, Providence, R. I. The tree is a vigorous grower, fruit medium size, very high colored, crimson and yellow, and, though not as good as some other varieties, will always be popular on account of its beauty.

Pyrus Japonica—Japan Quince.

Mr. Solon Robinson exhibited some of the largest specimens of the fruit of Pyrus Japonica ever seen by any member of the Club. This is the fruit of the common flowering shrub known as Japan quince.

Seckel Pears.

The most interesting part of the exhibition, however, came from Mr. Edward A. Dudley, Fern Bluff, adjoining Quincy, Ill., who

sends us a box of most excellent pears, under the name of Seckel. All we have to say of them is that they are Seckel in taste; but in no other particular. They do not answer the description of the books in form nor color, nor are they like Seckels grown in this vicinity. We had some, a few years ago, from Messrs. Beatty, Aurora, N. Y., equally large, but of true Seckel color, while the prevailing color of these is yellow russet, very slightly blushed. The stems and calyx, too, are unlike the true sort. This change in appearance, however, is no greater than it is with many varieties of apples grown in this or in Western soil. Mr. Dudley attributes "the size as well as the lusciousness to the health of his orchard, and that in a high degree he considers owing to the advantages of soil, situation and surroundings. My farm is one-half mile east of the Mississippi, and my orchards are on a ridge, and its spurs, a good surface soil over clay, with limestone substratum—perhaps some portion of iron ore gravel mixed in the soil—fine drainage, with forest on the north, north-east and west sides. I have about 2,000 pear trees, of which some 1,600 are the dwarfs. My Kirtlands, Duchess, Bartlett, White Doyenné, Louise, Belle Lucrative, Swan's Orange, Vicar, Lawrence, Beurré d'Anjou, Doyenné Boursoch, all, with some other varieties, fulfill all I could have hoped for—more than I expected. Some varieties have proven worthless with me—Van Mons, Leon le Clerke, Beurré Gris, and a few others. I think much of the fatality that has befallen the pear in our State is traceable to a too rapid growth, in view of the frequent and sudden changes of temperature from one extreme to the other, both in the fall and spring, and to the presence of unripe wood some seasons on the approach of winter, as was specially the case last year—many trees taking a second growth, some proceeding so far as to form young fruit. The small amount of damage sustained by me, under the circumstances, leaves me with increased hope and encouragement for the future. Please let me know (through report of proceedings) if any of the members of the Club can equal these Seckels, or surpass them, from their orchards. I have many other varieties promising well, but too young yet to bear; and time must test their worth to me. It has been suggested by some persons here that this may not be the true Seckel, but a new variety.

Mr. D. T. Quinn.—It appears to me there must be some mistake about these specimens. Some of them are decidedly Seckel in taste, and a little in appearance; others are not. However, all

that I have tasted are most excellent pears, and I am glad to hear they can be produced in such perfection in Illinois.

Dr. Crowell suggested there was a kind of pear called false Seckels.

Mr. Solon Robinson said it was due to Mr. Dudley to say that he writes—"I did not conceive the idea of forwarding any pears to the Club, until the suggestion was made to me by a friend; and after my first specimens (size, with perfect development) had been disposed of, a small portion only of my crop remaining."

At the suggestion of the Chairman, a unanimous vote of thanks was given to Mr. Dudley, with an addendum that if these are true Seckels, they are the best ever exhibited to this Club.

Mr. R. G. Pardee—I was lately in Niagara county, N. Y., and along the shore of Lake Ontario, where I found a bountiful fruit crop. In a ride of seventeen miles, I noticed pear orchards upon almost every farm, generally of the dwarf varieties. The apple trees, too, were loaded, and the fruit uncommonly fine. There are also more peaches in that section than in any other which I have seen or heard of this year. Fifty-nine tons of peaches were shipped from Lockport in one day last week. A farmer in that neighborhood sold his peach crop, growing upon five acres, for $2,000. I have lately been upon the shore of Lake Michigan, where the apple crop is very fine. While I am speaking, I desire to take the opportunity of once more indorsing the Wilson strawberry as the most productive and most profitable market berry ever grown.

Use of Marl and Sod Ground for Strawberries.

Mr. Henry Glosser, Unionville, Glocester Co., N. J., says he has lately moved to that place from the State of New York, and is grubbing out the roots and bushes to make a fruit farm. He inquires: "What if I use five tons of marl per acre, and grow clover, and turn that under and plant strawberries upon the sod?"

Mr. Cavanagh would not advise to plant strawberries the first year. Better plant some other crop the first year after breaking up the land. Then plant strawberries the second year. He thinks we cannot manure strawberries too highly. He has tried raising them with and without manures; and he thinks it pays to manure strawberries, and they cannot be raised profitably without abundant fertilization.

BLACKBERRIES.

Mr. Wm. Lawton, of New Rochelle, said he does not believe in manuring strawberries too highly. Blackberries, he said, require a good, deep, rich soil. They will not succeed well if neglected. The soil must be regularly attended to. The soil must be prepared, as for a crop of Indian corn. The ground must be manured highly. You cannot put on too much manure. The bushes should be mulched well, in order to produce a heavy crop of fruit. The same attention is necessary for raspberries. With suitable care any one may raise an abundance of fruit. He would caution those who would raise good berries to cultivate with great care. The best fruit is always found on the lower shoots. Therefore, prune closely, and train the bushes low.

SEEDS FROM JAPAN.

Prof. Tillman presented several varieties of seed sent by Mrs. W. B. Mangum, from Japan. Mr. James Hogg said the seeds were of a kind of persimmon, very different and much more valuable than the American variety.

SPIDERS—ARE THEY INJURIOUS TO FARMERS?

Dr. J. V. C. Smith, who stated that he started upon this inquiry under the supposition that they ranked with the class of injurious insects. Investigation has proved that he was mistaken in that opinion. They are not only not injurious, but are highly beneficial to the cultivators of the soil, indeed to all phases of civilized life. They do no damage to vegetation, but subsist entirely upon insects, destroying many which, if permitted to live, would be injurious to farmers, and this seems their specific function. The natural habits of the spider are remarkable. Each one seems to live a solitary life. Even the sexes war with each other; the female spider often attacks the father of her family, kills and eats him, probably to save her progeny from being eaten. The whole family seem to be extremely pugnacious; individuals fight whenever they meet, and one tribe attacks another, killing and eating their victims. Their anatomical structure is very curious; they have neither lungs nor brains. The air which oxygenizes the blood is drawn through a set of tubes, curiously arranged through the body, and furnished with valves by which the air is confined at the will of the insect. Instead of brains there is a set of ganglions, running through the body which answer the purpose.

Snakes, worms and other animals of the lower order, are like the spider in this respect. A spider has from four to six eyes which are so strong they enable it to see night or day. They have six jaws, and six legs furnished with hooks at the end, which enable them to perform some curious feats. They are oviporous, and the young, as soon as hatched, show the solitary habits of the old ones. Some of them carry their eggs in a sac attached to the body. Their power of spinning their threads is wonderful. Naturalists state that some kinds spin one hundred strands, which are united in one directly after leaving the body. If a spider wishes to descend from a ceiling, it glues the end of the thread fast, and lets itself down, and ascends again hand over hand. It is a curious fact that the spider, like all domestic animals, is ambidexter. Anatomists have failed to fathom the mystery of man's being right-handed. It is a curious fact that spider-webs are always made to suit circumstances, and their work implies thought and memory. They are like some of the crustacea and other low orders, lobsters, for instance, which have the power of growing new claws. If a lizard's tail is cut off, nature soon replaces it, and so it does a spider's leg. As to the bite of a spider being poisonous, it is a mooted question. It is believed by those most competent to know, that if the bite is inflicted when the animal is very much excited and really ferocious, that the bite is poisonous. The whole family appear to be as untameable as sharks, and as much at war with every other species. They will boldly attack insects twice their own size, and seem to delight in torturing their victims. I have seen one attack and kill a large caterpillar, leaving it for the food of a beetle, which dragged it away as soon as the spider had destroyed its life. It is very curious to see a spider watch a fly that is entangled in its web. I have seen one wait till the fly ceased struggling for a moment, and then run out and attach one cord after another to prevent the escape of its victim. Sometimes it is kept in suspense, or to furnish a supply of fresh meat every day. It is very curious to see how quickly a spider will reconstruct its web when destroyed. The senses of sight, taste, hearing and feeling, appear to be very acute in all the family. The body seems to be all ears. If you cut off a spider's antennæ, it runs itself into all sorts of difficulties. Like other insects they possess remarkable strength. An ant will carry a load fifty times the size of itself. The characteristics of spiders seem to be particularly adapted to various localities. Here we

have that numerous small class which almost cover the fields with their webs, and, of course, entangle numerous mosquitoes and other insects. In the tropics there are spiders' webs large and strong enough to entangle birds. All attempts to utilize spiders, I think, must be abandoned. Some fabrics have been made at great expense from their webs, but these little creatures cannot be domesticated, controlled, nor made useful otherwise than in the wild condition, in that they should not be greatly interfered with, certainly never destroyed. There is a tradition that a spider's web is valuable as a styptic; that is an idle notion, for it possesses no medicinal property, and as a styptic is no better than a sponge or other soft material. It is worthy the attention of all of us in studying the history of insects, worms and reptiles, to learn which are, and which are not injurious, and throughout all nature observe how one animal preys upon another—man upon them all.

Grape Soil in Ohio.

Mr. F. R. Elliott, Cleveland, Ohio, gives it as his opinion "that the best grape soil in this country is the calcareous clay which is found in isolated patches along the shores of Lake Erie, in the vicinity of Cleveland. He esteems this location better for vineyards than the much more celebrated Kelly Islands. He also gives it as his opinion that Ohio wine made without any addition whatever to the grape juice from grapes grown upon calcareous soil, is the purest and best of any wine made in America. There is, also, a richness, color and bloom given by a certain class of clay soils not attainable in any loam or sand, although this loam or sand may present equally as fine, if not better branches and more wood on the vine.

Hen Lice.

Mr. T. H. Morse, Plainfield, Union county, N. J., says:

"I clear my premises of lice in the following way: I close the hen-house as tightly as possible, and fumigate it with burning sulphur until I think everything is completely saturated with the fumes. Then give the hens plenty of dry wood ashes to wallow in."

Mr. J. H. Parmelee, Duncan's Falls, Muskingum county, Ohio, says:

"First clear out the old nests and litter, in which the lice breed and live, and burn them. Then pour a pound or two of sulphur

along upon the ground within the roost, and burn it with pieces of old leather, keeping the roost shut."

The same writer recommends poultry to be "always supplied with corn, green food, or roots, lime, and gravel, and ashes to wallow in. Never keep a hen past a year old for the sake of her eggs. For this purpose it is better to reserve every year a small stock of spring chickens, and feed always as above directed."

Mr. Alb. Steinbach, Evansville, Indiana, says his wife keeps the lice out of her hen-house by rubbing the perches and other parts with grease twice a year, once in spring and once in midsummer.

Decay of Orchards.

Mr. S. S. Fallap, Fallapburgh, Michigan, writes: "Might not the decay of orchards be attributed to excessive pruning, cutting off large limbs, leaving scars large, and liable to rot back and finally produce decay? I have observed in this new country many comparatively young trees that are already decaying from this cause. While in New England, a few years ago, I thought I saw many trees with large decayed places from this cause."

Mr. Solon Robinson—Such pruning is, doubtless, injurious to trees; it is not the cause of the general decay of orchards. You might as well attribute it to the fact that the trees were transplanted in the old of the moon a hundred years ago. I saw some orchards last week, in Westchester county, which have probably borne fruit that number of years, and have always been healthy and productive, till within a few years past, which have now gone the road of ten thousand others, in New England, New York, New Jersey, and Pennsylvania. One old orchard in particular which I noticed had always been most carefully and judiciously pruned, yet it is going the way of all others. It is not likely that such a thing as an old orchard will be found in existence ten years hence, if the present rate of decay continues. Apple orchards are perishing as surely as peach orchards have perished. It is idle to deny the fact, and useless to theorize upon the cause. The only remedy is to continue to plant young trees."

Adjourned.

October 2, 1866.

Mr. Nathan C. Ely in the chair; John W. Chambers, Secretary.

Owing to this being the opening day of the annual fruit show of the American Institute, there was a large attendance. Yet the discussion was not as varied and interesting as it is at some other times, because all minds appeared bent in one direction, that is, upon the show of fruit, flowers and other things in the exhibition rooms.

P. T. Quinn called the attention of members to an exhibition of fruits from Vineland, N. J., grown in the despised sands of that part of Jersey. There are specimens of pears larger than any of the same variety from any other locality. He is a large successful pear grower himself, but acknowledges beat. He attended an exhibition at Vineland last week, where the fruits, flowers and vegetables would have done credit to any county or State exhibition in the country. Duchesse pears of fifteen to twenty ounces each were so common as hardly to excite attention on account of their size. Grapes were abundant and remarkably good, Catawbas particularly. Culinary vegetables were so abundant, there was no room in the great hall for their proper exhibition. They were in stacks and piles on and under the tables, and altogether made such a show as he had never seen before. There was also a great show of people, estimated at 5,000, who were all attentive listeners to Mr. Greeley's address. He remarked that he never spoke to an audience which seemed to appreciate his lessons upon agricultural improvements as fully as that at Vineland. Men and women appeared to be all in earnest.

The settlement of the Vineland tract commenced about four years and a half ago. It has now a population of about 9,000, and it has been lately ascertained that there are 500 acres of strawberries, 250 acres of grapes, 200 acres of apples, 250 acres of blackberries, 175 acres of pears, and over 200 acres of peach trees. But the most remarkable part of all this fruit planting lies in the fact that more than 3,000 fruit trees have been planted by the roadside. It is one of the requirements of all purchasers of land that the roadside shall be ornamented with trees. At first, shade and ornamental trees were planted. Of late the fashion all runs to fruit trees. The consequence will be a large settlement unlike any other in America. It is reviving a good old German fashion.

I think those who have been most skeptical about the West Jersey soil, would have been convinced that it is not barren, by witnessing the late exhibition of agricultural products at Vineland. Its productiveness has astonished everybody, and the prospects of the new settlers there are certainly flattering. I wish Solon Robinson could have been present on that occasion, for he has been the worst abused man for what he has written of the fertility of what his abusers have been pleased to call "the barren sands of West Jersey." He and they if they had been present at that show, would have had the most tangible evidence before their eyes, that his statements were all true. It is true that the soil is sandy, but it must now be acknowledged that it is wonderfully productive.

Mr. R. G. Pardee—There are 100,000 acres of similar land along the Raritan Bay railway within a few hours of New York, which can be bought for ten to twenty dollars an acre, and this land is near the Squankum marl pits, the great source of the fertility of those sandy regions, and also half way between the great markets of New York and Philadelphia. Solon Robinson said gentlemen need not go to Jersey to see wonderful products of sandy soil and marl; they are now on exhibition in the next room, and excel all others in size of pears and in several other particulars. Indian corn grown upon those "barren sands" takes the prize, competing with several very excellent specimens. In fruits, Mr. Ellis takes five prizes for his Vineland products—the fruits of that region of country, about which I have written a good deal, and been a good deal abused for what I have written, by people who had prejudged the land as barren, because it was sandy, without stopping for a moment to inquire what might be mixed with it that would make it productive of food crops. I remember very well when the *Tribune* published my first letter five years ago, how it and the writer were denounced as having been "bought up" to recommend that "barren desert," which is now known as Vineland. Then I believe there were three families, exclusive of the semi-civilized coal burners; now there are, Mr. Quinn says, over 9,000 people, and the products of the soil excel those of regions hitherto considered the very best; and they come here and win golden prizes and golden words from our best fruit growers around New York.

Failure of Apples this Year.

Mr. H. P. Smith, Westfield, Mass., spoke of the general failure of the apple crop this year, and asked if members had observed that profuse blossoming does not always indicate profuse bearing. In my section, while all other sorts fail, there is a fair crop of Baldwins. Can any one tell why?

Dr. Sylvester, Lyons, Wayne county, N. Y.—I account for it in the different time of blossoming. I think the blast was occasioned by the northeast storm, which with us blasted a great portion of all sorts but Baldwin and English Russets.

Mr. Solon Robinson.—That theory won't hold good, because the time of the storm in different sections would not correspond with the time of blossoming of the several sorts.

Mr. H. P. Smith.—That is true as regards our section, where Rhode Island Greening and Baldwins bloomed at the same time, and were subject to the same influences, yet we have a fair crop of Baldwins and no Greenings.

Mr. E. Williams, Montclair, N. J.—I have observed the same results where I live. The causes of failure I have never been able to account for satisfactorily. I sometimes think that the more we try, the less we know. I think I have observed one thing so long that I do know it, and that is, that profuse blossoming is never followed by a large crop of fruit.

Mr. Wm. A. Elvins, Hammonton, N. J.—We have one man in our settlement who grows good apples every year by keeping up an unceasing warfare with curculio and codling-moth. He jars the curculio from his trees and kills them. He gathers and destroys all the early falling fruit that contains worms, and keeps his trees free from borers, and in every way possible destroys insects, which are the principal cause of fruit failures.

Mr. R. G. Pardee—For gardens and growers of fruit on a small scale, it is perhaps feasible to undertake to destroy all the insect enemies. In my opinion it is better to use fertilizers which are not conducive to the health of such insects. I am satisfied that all soils may be purified by the use of the salt and lime mixture so often recommended, which is made by saturating water with salt and using the brine to slake lime, which being exposed to the atmosphere in a dry place effloresces into a light powder, in which condition it should be applied.

Dr. Snodgrass—That is simply chloride of lime. Those who

do not wish to prepare it in the way recommended for small gardens, may purchase it at little cost of the druggist.

Professor Nash inquired if it would injure plants.

Mr. R. J. Dodge replied: Yes, if you put it on in excessive quantities; so will anything else, even bone-dust; but not if the lime is applied moderately, anywhere from three to thirty bushels an acre.

Gas Lime.

Dr. Sylvester said he had used gas lime the present year, spread upon the surface under plum trees, and obtained more fruit than previously in five years. Yet he could not say that it was entirely owing to the lime, as his neighbors who used none also had more fruit than usual. He has, however, faith in the benefits of gas lime, and will continue to use it, being careful not to apply it too freely.

Mr. William Lawton—A neighbor of mine grows his plum trees in the grass, and gets fruit every year.

Insects upon Locust Trees.

Dr. Snodgrass stated that he had lately observed, in a journey through the Shenandoah Valley, that the locust trees were almost universally affected by some insect which eats the leaves full of holes, and farmers are very anxious to know whether, if continued, it will not kill the trees.

Dr. Sylvester and several other members spoke of the destruction of locust timber throughout the country from Maine to Iowa, by an insect which bores into the limbs, causing the tree to die from the extremities inward. The bodies of many valuable trees have been saved by cutting off all the tops. New limbs sprout out freely, and in many cases afterward the trees have been found exempt from borers.

Mr. N. C. Meeker said that in Illinois, a great many locust trees had been killed to the roots, and any remedy for the locust borer would be hailed with great satisfaction.

Raisin Grapes.

Mr. Elvins exhibited some of Asher Moore's new seedling grapes, which dry upon the vines into a passable raisin. There were two other sorts exhibited in the fruit show which many persons think will become valuable grapes to dry into raisins.

A New Seedling Grape.

Mr. Robert L. Dorr, Dansville, Livingston county, N. Y.—"Four years ago I planted two hundred and fifty seeds of the Delaware grape. One plant proved a remarkably vigorous grower, making about six feet that season. I transplanted it next spring, and it made fifteen or twenty feet that season and bore fruit, ripening with the Delaware. It continues to prove hardy and vigorous as the parent, but produces berries of much larger size. As I received the seed from Charles Downing, I propose to call it the Downing Seedling. I send by express a box of these grapes for exhibition."

Aldrich's Patent Fruit Ladder

Was exhibited to the club and well approved. It is made in four parts, the two longest portions forming ladders from the ground up to the two shorter parts, upon the top of which is a platform, and the whole so movable upon the joints that it can be shifted into any position and at various heights.

Hen Lice.

Mr. W. S. Lunt, Fostoria, Ohio—"I have found sulphur sprinkled in the nests, over the floor or ground, and along the sides of the buildings where fowls are kept, never fails to make lice entirely disappear."

Mrs. J. D. G., Leroy, N. Y.—"After having the hennery thoroughly cleaned and whitewashed, sprinkling lime on the floor, I gave corn meal and sulphur—two tablespoons of sulphur to two quarts of meal—to twenty-five hens three times a week; also rubbing a mixture of lard and sulphur under their wings. They like the sulphur, and it won't hurt them. In one week the lice were all gone, and stay gone."

Mr. P. M. Varney, Brant, says: "Sassafras poles for roosts, or sassafras roots or bark scattered in the roosts will keep it clear of the pests."

Mr. J. M. S. Hopewell, Ontario county, N. Y.—"Dry unbleached ashes always on hand for hens to wallow in will keep them clear of lice."

Corn Cobs for Feed.

Mr. S. S. Coolidge, Bellows Falls, Vt.—"A diversity of opinion exists among the farmers and feeders of the Valley of the Connecticut, respecting the value of cobs, when ground with corn, for feeding stock. Are its qualities nutritious? Do they aid digestion?

Dr. Snodgrass—They do probably aid digestion, because the corn meal is too concentrated, and needs a mixture of some coarser substance, like cob meal.

Mr. H. P. Smith—The farmers in our section of country have come to the conclusion that corn meal is not too concentrated for feeding beef cattle. I grind corn and cobs to feed milch cows, to increase the quantity of milk for sale, but the beef feeders are most successful on the highest concentrated food; and they esteem corn meal, ground fine and fed fresh from the mill with good clean hay, the best substance known for fattening cattle. They do not think corn cobs of any value for such purposes.

Mr. William Lawton thought they must be nuitritious, because he had often seen his cows pick them up and eat them.

Dr. Sylvester is convinced of their being nutritious, because his father always fed weak young lambs upon corn cob tea to revive them. For a milk dairy he thought them very valuable, where quantity of milk was an object, though he believes the richest milk comes from corn meal to cut hay. He also recommends buckwheat highly for cow feed.

Mr. Solon Robinson—I believe, from what I have observed in my own case and that of others, that the benefits to the lambs would have been just as great from the use of hot water without cobs as with. I believe, too, that it has been pretty well settled, by a great many practical experiments, that corn cobs are less nutritious than rye straw and other similar woody fiber. The twigs of basswood, maple, ash, and several other forest trees, are decidedly more valuable for cattle feed than cobs. Whenever a farmer has settled in his own mind that it will pay to grind basswood rails to mix with his corn meal, he may be morally certain that it will pay to grind corn cobs. Whenever wood is worth four or five dollars a cord, there is no purpose to which cobs can be so profitably applied as for fuel. As they contain more potash than any kind of firewood, the ashes should be carefully saved for the leach tub, or to apply to the growing corn, for which there is no better manure. The statement of Mr. Smith about the Westfield (Mass.) cattle feeders, if not conclusive, is valuable, because they are widely known as a class of highly intelligent farmers, who feed bullocks for a profit, and succeed in making some of the best sold in the New York or Boston market; as they have tested the value of cob meal, and find that it will not pay to grind cobs, even

where hay bears the high price that it does among the tobacco growers of the Connecticut River Valley.

FRUIT GROWING IN POTS.

Mr. N. C. Meeker.—While at the Pennsylvania State Fair, held at Easton, I saw fruit growing in pots, and as it was new to me, I give the particulars as to the mode of cultivation.

Frederick Seitz, a brewer, in Easton, had on exhibition twenty-four varieties of peach trees and some nectarines growing in pots and loaded with fruit. The pots are from twelve to fourteen inches tall, and have a capacity of about five gallons, while the trees are from two and a half to four feet high. Each pot has an opening of about one-third in the bottom.

The orchard house, usually a lean-to, should not be less than fourteen feet wide, and as long as one pleases; it is similar to a cold grapery. The lower side is four and two-third feet, the upper is twelve feet high. Mr. Seitz's is forty-four feet long, and holds eighty trees. The pot stands over a place which first is a hole made by digging out a few shovelsfull of earth and then filled with rich soil, usually compost. In this fibrous roots will form, descending through the pot as the soil in the pot is not sufficient to produce fruit. When the fruit is ripe the pot is tipped on one side, and these fibrous roots are cut off. This is done that the wood of the trees may harden and the fruit buds develop themselves, otherwise the tree would continue to grow and produc a mass only of green soft wood.

In the fall the pots are put away close together in a corner, heaped up with dry soil, tan, or sand. It is a good way to dig a trench ; place in it the pots and cover them up with soil, but not any of the branches. The point aimed at is to keep them quite dry, subject to no change and to exclude the sunlight with some covering. The air should be cold—frost is to be avoided, though it will do no hurt if the roots and trees are dry. A cellar sufficiently large would be a good place.

Mr. Seitz thinks it would be a good plan to have the trees placed in the sheltered spots during the warm and growing season, and he intends to try it next year.

The process of planting is first to place in the bottom of the pot broken pieces of stoneware, crooked, an inch or so deep, as spaces for the roots to work down through, then soil is added in quantity according to the roots, for the tree must be set in its accustomed

depth, and this soil is to be packed down with a pestle, as solid as a turnpike. Then the tree is set, the soil placed among the roots, and packed to the same hardness with the pestle, till the work is finished. This is for the reason that when the tree bears it wants all the soil it can get, and there will be none too much.

In the fall and early spring, when the tree is dormant, what soil can be taken out around the trunk and over the roots is removed and replaced with fresh compost.

In the spring, after the trees blossom, they frequently are syringed with water to kill the little red spider which is almost invisible, otherwise it might kill the tree. Before the trees are set away in the fall, their trunks and limbs are brushed with a thick solution of sulphur and nux vomica, to kill the great variety of insects which harbor in such a nice place. If not killed they would destroy the buds and the tree.

While the trees are growing fast each pot requires a gallon of water a day; in less growing times a pint of water will do, or a quart every other day. Once a week each is watered with liquid manure. It is necessary to thin out the blossoms to the number the tree should bear. A good cistern should belong to the orchard house. One of these trees will bear forty or fifty very large peaches.

Thus far, Mr. S. has grown only peaches and nectarines, but he is introducing plums and pears and cherries also, which he says do remarkably well.

The grub gets in these trees just the same as if grown outdoors, and requires to be got out twice a year.

One may take a poor peach tree one year old, and having fruit buds, transplant into a pot, and it will bear the next year. Any variety, one year from bud, will answer. But the best is called "The Buchanan." This is said to have originated in Georgia. Even in the open ground it does not grow more than five to six feet high. The fruit is very fine, the tree one of the hardiest. From its drawf nature, the limbs being only a few inches apart, and the buds in clusters, the fruit hangs like grapes.

In cultivating in this manner knowledge and attention is required. Common sense is good, though it is a scarce commodity. The trees on exhibition were loaded with beautiful fruit. O ye rich folks on the prairies, take this little story to heart.

Mr. Seitz told me this: that a person who has no orchard house can raise these dwarf trees by keeping them in a cellar in winter,

and in a warm nook in the garden in spring and summer. A lady can raise little cherry and nectarine trees, and make folks hold up their hands on seeing her fruit. The way to do it I have told.

Adjourned.

October 9, 1866.

Mr. Nathan C. Ely in the Chair; John W. Chambers, Secretary.

Aldrich's Patent Fruit Ladder.

Messrs. Lippincott & Co., presented one of Aldrich's fruit ladders, six feet high. This is a double ladder, and has a large and wide platform on the top. It furnishes a place for the basket as well as the fruit picker. It is so arranged as to be used on a hillside as well as level ground, with equal facility.

The Chairman spoke in high terms of its utility.

Mr. John G. Bergen thought it might answer very well for gentlemen situated like the Chairman, with a few trees upon a small plot of ground. He did not think it would be readily adopted in place of the old-fashioned ladder by those who have extensive orchards, or pick fruit for market.

Mr. Solon Robinson said that one of six feet high, like this before us, might answer just as well as the ordinary "step-ladder," and probably no better. When it comes to mounting fifteen or twenty feet high, for his part, he should prefer to have the ladder supported against a tree.

Preserving Fox-Grapes.

Mr. Isaac Hicks, Westbury, Long Island, sent a jar of preserved fox-grapes to show what a good article can be made from that fruit. He says if any of the Club desire it he will furnish the method of preparing it. Some of those who tasted this article, and approved it highly, would be glad to learn.

Sweet Potatoes.

Mr. Solon Robinson exhibited specimens of sweet potatoes weighing twenty-six ounces, grown at his place in East Yonkers, sixteen miles north of the City Hall, for the purpose of inducing others to cultivate this excellent vegetable, notwithstanding they may live further north than it has been heretofore supposed sweet potatoes could be grown to advantage. I have tried, said Mr. R., twice before, but without success. This year it has been all I

could desire. I have four barrels of tubers, of excellent quality from a piece of ground forty by fifty feet. The soil is a loam in which sand rather predominates. It was highly manured last year as part of the ground upon which a crop of pickles were grown. The only manure used this year to produce potatoes was flour of bone. It did the work and did it effectually. The plants were grown by M. M. Murray, Loveland, Clermont county, Ohio, whence they were forwarded by express, and came to hand in good order in five days, and were planted before the 15th of May, the ground being first thoroughly plowed, and then worked into mounds, about a foot high, upon the top of which the plants were set. For some weeks they looked as if it was a hard struggle for life, but neither water nor shade was given them, that theory having proved fallacious in a former season. So had the attempt to grow them upon a level surface. But after all, I believe the great secret of success this year, is the bone manure. The growth of tops was most luxuriant. Twice in the season a man went over and lifted them from the ground to hinder their taking root at the joints. Care was taken as soon as the frost touched the vines last week, to pull them up, for if left to die while attached to the tubers, their quality is sometimes affected. The variety is called Yellow Nansemond. Mr. Murray sends out with his plants particular directions for cultivation. He recommends rolling ground, mellow and warm, and planting in ridges manured, unless the land is in first-rate condition. He sets the plants in the ridges fifteen inches apart, which will require ten thousand plants per acre. In hills, as these were grown, about six thousand plants are sufficient. If every one could have the same success that I have had this year, I am sure every farmer would grow sweet potatoes.

Mr. John G. Bergen.—I have made some experiments the past summer with bone flour, comparing it as to cost and results with other manures. On squashes and beans it did full as well, on melons, cabbage and cauliflower, better than other manures. Upon the whole, the results are highly favorable.

Mr. H. P. Smith.—I was upon the farm of David Gould, Quaker Hill, Dutchess county, not long since, and he assured me that he had tried bone manure for two or three years without being able to see any advantage over crops planted without manure. I do not know whether he used the bone flour; my own experience in Westfield, Mass., has been highly successful with that.

Mr. William S. Carpenter—I do not know that bone dust is equally beneficial to all soils. With me it is best in clayey land. I once used coarse bone upon Indian corn without any benefit. The land was then seeded to grass, and then continued to improve for seven years.

Fence Posts.

Mr. H. P. Smith.—I wish to introduce what I conceive to be a very practical question for discussion by this or any other Farmers' Club. What can we do to improve fence-posts? Most of the wooden ones decay so rapidly they are hardly worth setting. I have examined all the iron ones in market, and find none with which I am satisfied. There is a great need of something better. What shall it be?

Mr. William S. Carpenter.—The best plan that I can conceive is to plant locust trees in all the waste places about the farm and grow our own posts. I have some that were set by my father, probably fifty years ago, still sound.

Messrs. Bergen, Robinson, Crowell and others, expressed themselves pretty decidedly in favor of teaching farmers how to do without fence, as preferable to teaching how to preserve it.

Cut Grass Early.

Mr. Solon Robinson.—A correspondent asks: "Are the Club aware of the importance of urging the farmers to cut their hay early, since it exhausts the land far more to ripen the seed than to grow the grass up to the blossom? My observations of fields that were commonly mown early or late, confirm this opinion. It is particularly noticeable where patches have been left for seed." We think the Club is not as well aware of the importance of such a recommendation as the gentleman himself. It may be important to the land to cut grass early; it is not quite so well settled that it is important to the stock. A good many of the outside members of this Club have certified their opinions in favor of letting grass come to a reasonable degree of maturity before it is made into hay.

Spontaneous Growth of Trees.

Mr. Solon Robinson.—This subject is attracting considerable attention. Among a large mass of letters I find a great difference of opinion.

Mr. J. A. Donaldson has the following theory of their origin: "It may be that a large portion of the prairies was once woodland. But the annual fires gradually extended the prairies by killing the trees, but leaving the roots alive. The roots would sprout and grow through the summer, and the fires kill to the ground in the fall. Checked so often they would make a feeble growth, consequently would be hidden from view in the grass until after the fires are stopped." That's a very plausible theory; the only objection to it is, it is not true. The only possible way of accounting for the existence of prairies, is to suppose they never have been wooded since the floods receded. We also know that trees start into existence where there is no appearance of any of the same variety ever having grown before since the world began. And this assertion, also, upsets the theory of Nathaniel Vose, who writes from Waukegan, Ill., about the "stool grubs," which settlers have had to contend with, and with which he seems to know the writer of these reports is acquainted. He says: "Where I now sit, beautiful groves of young timber, some of it a foot in diameter, have grown up from these stools, where, thirty years ago, grass was the principal production, but where the annual sprouts of oak and hickory struggled for existence. In the wild state, the annual fires were all the time encroaching on the timber and driving it back, and as westerly winds prevail generally in autumn, the fires have usually made a clean sweep on the west of rivers and lakes, where there is usually a belt of timber on the east side. I have seen thousands of acres in southern Kansas where young groves of oak have been destroyed by fires within the last four or five years, and from which the dead trees or brush will be soon consumed if the fires are not stopped, as the annual growth of grass grows denser; but when the fires are stopped, these tracts—as well as other thousands of acres which only show a feeble annual growth, overshadowed by the tall grass—will send up *spontaneously* from these germs groves of oak and hickory, as at Lawrence. These groves are never found out on the prairie, away from the vicinity of timber, or where there has been timber, leaving perhaps only a few insignificant grubs, but which, nevertheless, are the authors of spontaneous groves. And it would be strange if the extensive timber bottoms of the Kaw and its many branches could not establish a relationship to the adjoining groves."

We have given the argument of Mr. Vose at length, but it is

still untenable, because groves do start up away from streams, and away from any connection with other groves, and in places where there are no stool grubs for a beginning. And so are immense tracts immediately covered with a growth of oak where nothing but pines grew before. Still we do not say that the growth is spontaneous; but if it is not, the whole is involved in mystery.

Mr. Samuel Armstrong, Pleasant Ridge, Kansas, writes: "There must be a seed to start the individual, or buds, eyes, &c." Acorns, hickory and hazel nuts, &c., are stored in the ground by the prairie squirrel, gopher, &c., for winter use, many of which are left and grow. Previous to settlement, annual fires swept the prairies, destroying the summer's growth, leaving the root to sprout and grow, and be destroyed each year in the same manner. An examination of what is called stool grubs, will satisfy any member of your club that this is the case, and accounts for what Bayard Taylor called spontaneous growth of forests.

Dr. J. V. C. Smith gave the club the benefit of his observations all over New England, of the springing up of one kind of timber where another had been cut away. As to the origin of prairies, that is a mystery. Unlike the bogs of Ireland, they do not give evidence of having once been timbered. It is there a common business to probe the bogs for buried trees, and large logs unlike the present growth of Ireland are obtained. Notwithstanding the unaccountable growth of trees where nothing of the kind had previously grown, they may all come from long buried seeds. An artesian well was bored near London a few years since, and the next spring it was observed that some plants were growing in the dirt taken out. They proved to be red raspberries, yet none previously grew in the vicinity. I have lately observed that mammoth bones, an ostrich egg and large trees have been found at the bottom of a deep well in Troy, N. Y.

Dr. Snodgrass.—There is a very great difficulty in accounting for the growth of trees on the prairie, if we must refer their origin to buried seeds. They certainly do not always spring up from visible roots. If they came from seeds, the question is certainly very pertinent, how came they there?

Mr. John G. Bergen said that he was an utter disbeliever in the spontaneous growth of anything, and he did not believe anything has been created anew since the close of the six days of Creation.

Professor Tillman, thought we had better wait a little before we declare spontaneous production impossible. The Academy of

Science of France, is now engaged in the most thorough experiments for the elucidation of this question. Some of the strongest opponents of the theory of spontaneous production have lately been compelled to yield to the strong evidences which have been produced, both as regards vegetable and animal life.

Do Kingbirds eat Honeybees?

The Chairman.—We have two letters upon this subject, one from P. Peckham, Columbia X. Roads, and one from M. H. Boye, Coopersburg, Lehigh county, Pa., both of whom say they have shot the birds and found bees in their crops. Mr. Peckham thinks they could not have been drones, because he shot the birds early in the morning, before the drones were astir. He has also seen them catch bees on the flowers which are not visited by the drones. We still think, however, it is an open question, and will be until somebody finds bees in the bird's craw with the working bee's sting.

Mr. D. G. Skinner, Prattsburg, N. Y., settles this question, and that they do catch working bees. He says: "Kingbirds catch bees on their return passage to the hives. Their meal is from five to seven. I have frequently taken them from the crop, with bee-bread on their legs."

Grub Worms.

Mr. Thomas W. Reece, Windsor, Randolph county, Ind., says: "The pest has lately attacked our meadows and cornfields, nearly ruining the crops. Hogs won't eat them. How shall we get rid of them? Will they change to some other form, or continue from year to year as grub worms? Will fall plowing destroy or diminish them? In short, what is the cause that produces them, and the best plan to get rid of the pest?"

Mr. Solon Robinson—Fall plowing is recommended for this pest. A dressing of lime, salt or ashes, will also be found beneficial.

Adjourned.

October 16, 1866.

Prof. S. D. Tillman in the chair; John W. Chambers, Secretary.

A New Seedling Peach.

Mr. T. H. Ridgely, Baltimore, Md. sent specimens of a new seedling peach, grown in his garden, which is in perfection about the 25th of September, and continues to hold on upon the tree until the present time. It is like the Heath peach, some of them

ten inches in circumference; clingstones, and Mr. Ridgely says excellent. These samples, however, did not warrant that appellation. Their flavor had evidently been impaired by some substance that had been in contact with them. Mr. Chambers, the secretary of the club, stated that they had been packed in old newspapers. Mr. Meeker said that petroleum was used in printers' ink, and that alone was sufficient to ruin the flavor of any delicate fruit. From this little fact, those who pack fruit for transportation may learn a useful lesson. Probably the best packing for peaches is peaches leaves. Any clean, sweet forest leaves or clean straw would be better than old newspaper. Rice hulls make one of the cleanest substances in which fruit can be packed. They have no odor nor tendency to mold. For very delicate fruit it would be necessary first to wrap each specimen in clean tissue paper.

How to Grow Celery.

Mr. Aaron Wright, Salem, N. J., asks: "Will the club please give some information in regard to the cultivation of celery—the soil best adapted to its growth, the best fertilizer to be used, and the probable and possible yield per acre?"

The Chairman called upon Mr. P. T. Quinn to answer these questions.

Mr. P. T. Quinn.—It makes but little difference whether the soil is clayey loam or sandy loam; it will grow in pretty stiff clay. There are two requisites, however, that cannot be dispensed with. The ground must be extremely rich, and deeply and finely cultivated. I would not recommend using an excessive quantity of manure with the celery crop, but I care not how much has been used with the preceding one. Around New York a celery crop follows early cabbage, early peas, or early potatoes. Then the ground being deeply and finely pulverized, it is manured with compost or some special manure, such as guano, superphosphate, flour of bone, etc. A gardener does not think he gets a paying crop unless he can make his celery plants grow two and a half feet high. The seed is sown early in spring; indeed it is one of the first sown in open ground. It is a common practice when the plants are a few inches high to cut off the tops, to make them grow more stocky. They are not ready to set out until June and July. They are then planted in rows three to four feet apart three and a half or four inches between plants. The trench system of planting is entirely abolished. When the plant have grown fourteen

or sixteen inches high, they are worked by what is termed hand handling, that is, the stalks being held close together, the earth is drawn up and pressed around them. Later in the season they are earthed up so as to form ridges two or three feet high. The quantity and price vary so much that it is difficult to state it. The range is from $200 to $400 per acre. For keeping celery so that it can always be obtained during the winter, a narrow trench is made fourteen to sixteen inches deep, upon a spot that has a slight inclination, and in this trench about the last of October, or before freezing weather, the plants are packed as closely as they can stand, and hay placed along each side, so as to be convenient for covering whenever a freezing night threatens; and before the ground freezes it is hauled up an each side of the row, the plants being previously closely pressed together, and then so banked up that only the center of the tops stick out. The whole ridge is then covered with coarse manure sufficient to prevent freezing. In filling the trench always commence at the upper end, and in taking out the celery whether for use or to send to market, always work up from the lower end.

Milk-weed as a Substitute for Cotton.

Dr. Henry Guernsey, New York, exhibited a variety of specimens of the raw material and manufactured articles from the fiber of milk-weed (*Asclepias cornuti*),and addressed the club at considerable length in the endeavor to convince the members that this fiber will become a substitute for, or, at least, a competitor with, cotton. He had specimens from South America, where he says it grows wild in such profusion that it covers extensive plains. He stated that it was also found in great abundance in Colorado. He thinks in places where it grows wild in this region it can be very profitably gathered, either for sale or domestic manufacture.

Mr. Solon Robinson.—I have listened with attention to the remarks of Dr. Guernsey, but he has not convinced me that milk-weed would be a profitable crop. Milk-weed has been experimented upon by a great many persons. I have seen nothing to sustain the idea that it can be used profitably in the manufacture of cloth. Neither milk-weed nor any other wild plant could compete with flax, cotton, hemp, wool or silk. Beside, it does not appear from these specimens of cloth that the milk-weed fibre is capable of being spun into anything but a course thread, and that none of the evenest.

Dr. Guernsey argued that the milk-weed fibre was better than flax or cotton, because it was permanently colored by analine dyes.

Michigan as a Fruit Region.

Mr. Phineas Allyn, St. Joseph, Mich., says: "The thermometer ran from 8° to 21° below zero last winter, being the coldest where least protected. The spring was cold and frosty. Berries produced about half a crop, and apples not more than a fourth one; grapes almost an entire failure. Many vines killed outright, among which Iona and Delaware suffered badly. Concord and Hartford stood it better. Peaches scarce one-tenth of a crop, yet crop enough. From cholera fright and other causes, peaches have not brought as much as last year, when we were shipping from St. Joseph 5,000 to 10,000 baskets per day. About the Agriculturist strawberry I wrote you last year. That letter seemed to be understood that it was not hardy here. I did not design to convey that idea. I stated facts of failures of plants to grow that had been received from C. Judd, J. Knox, &c. I will now state that the survivors and their progeny seem to have stood the last cold winter well, and show a vigorous growth of plant ahead of anything else. Mine bear splendid specimens of fruit, and I think if they can bear water-carriage 60 miles to Chicago, they will become one of our market strawberries. The Triomphe de Gand is in dishonor this year, but I think should not be condemned for one failure. It has been a good market berry heretofore. I marketed this year, from one-fourth of an acre of Triomphs, in first-rate order, seven bushels. They brought from $8 to $12 per bushel. The Wilson still holds its pre-eminence as a market berry. I heard a nurseryman the other day declare that 'No other but Wilson's Albany was worthy of cultivation.' Yet I did not quite believe it. I picked and marketed this year, from one-tenth of an acre of Wilson's a little over twenty-five bushels, and sold them at $6 to $9.50 per bushel, netting over $150."

Mr. P. T. Quinn.—One of the very important facts which strawberry culturists should learn, is that some varieties require much higher cultivation than others. That is the case with Triomphe de Gand. It needs double the amount of attention and manure that Wilson does. Adaptability to location is another great thing. There is no more successful variety than Hovey in the vicinity of Boston.

Mr. N. C. Meeker said that in Illinois $6 a bushel for Wilson will produce as great a profit as $12 a bushel for Triomphe de Gand.

A New Plow Coulter.

Mr. Solon Robinson.—Mr. C. Rowland, Chicago, has invented a new plow coulter. Its form is that of an arc of a circle, one end fitting in the point and the other in the standard of the plow, and is reversible. It is held in place by a screw belt through the beam. It is highly commended by Illinois farmers as superior to any other form, but none of the members present, in looking at the cut, can discover wherein the advantages claimed consist.

Mr. Wm. S. Carpenter said he had tried a number of coulters of different forms, without finding one that was any improvement upon the oldest style he has ever seen, that is, a straight bar firmly fixed in the beam, and having a sharp-cutting edge.

Improved Churn Dasher.

Mr. George Deckman, Malvern, Carroll county, Ohio, sends a specimen of what he calls an improvement of the old dasher churn. Whether it is such remains to be tested. It looks, however, about the smallest matter for a patent that we have lately seen. Yet as the dasher is the only churn that some persons will use, we are glad to notice every improvement of this indispensable piece of household furniture.

Mr. S. Edwards Todd.—The only advantage I can conceive that this dasher has over any other is, that owing to the shape of the under part it may enter the cream somewhat easier than the one that is entirely flat. A current, then passing through the holes of the lower part of the dasher and through those of the upper will meet sufficient sharp corners to cut the globules. The theory that butter is produced by chemicul action is exploded. It is by mechanical percussion which separates the oily from the watery portion of the milk. The separation can be made by heat, but the result will be entirely different. One produces oil, the other butter. It is possible the dasher will work more easily than the one more angular. It will also probably require more time.

American Prunes.

Mr. David Thompson, Green Island, near Troy, sends to the club, two specimens of prunes, and says: "The fruit sent is the gleanings from the trees, and sent at this late day, in order to show

how tenacious both tree and fruit are of life; for the foliage on this tree is now as full and verdant as it was in August, notwithstanding we have had several very heavy frosts, in short, that our vegetation is totally destroyed. The foliage of our dahlias has been withered, black and dead for some two weeks.

"The trees were imported from Prussia by myself fifteen years ago; they have borne ever since. No guming or black wart troubles them. The bark on the trees is as smooth as the fruit. Some of the specimens are dried on the tree almost to perfection. The fruit ripens about the 1st of September."

This tree is easier propagated than the plum, on account of its hardiness. And the small quantity of sugar required to preserve it, makes it a valuable family fruit. The tree is propagated from the seed, or sprouts, as they will not bear the knife. If grafted on the plum stalk, the tree sheds it foilage early in August, and its fruit does not ripen.

Adjourned.

October 23, 1866.

Mr. Nathan C. Ely in the chair; John W. Chambers, Secretary.

Duchesse d'Angouleme Pears.

Mr. J. C. Parsons, Vineland, New Jersey, exhibited a pear of this variety weighing 23⅝ ounces. It was grown upon a dwarf tree which had been planted out two years, and was two years old when planted.

Its cultivation has been only that given to potatoes among which it grew. Quite a number of pears grew upon the same ground that weighed sixteen to eighteen ounces.

Apples—The Old Question Revived—Apples Half Sweet and Half Sour.

Mr. John G. Bergen revived the oft exploded notion that apples can be grown at the will of the cultivatar, so as to be partly sour and partly sweet. Such had been lately exhibited to him by Mr. Kimball, of Brooklyn, which he said grew upon a tree in Connecticut, and that the origin of the sort was the uniting of two buds, one sour and the other sweet, which being inserted in a stock grew into a tree which produced these hybrid apples.

Mr. R. J. Dodge contended that such an origin was an utter impossibility; that such dissecting of buds would destroy the life-

He had often seen these mixed sweet and sour apples, but it was only a freak of nature.

Dr. Jarvis thought that if any mixture had occurred, it was through a mixing of pollen and not a union of buds. No such anomalies are found in the natural condition of fruit. It is possible that the nature of these apples has been entirely changed by cultivation, so as to produce fruit of the hybrid character mentioned.

Dr. Snodgrass thought we must take that statement as authority in opposition to all theory.

Mr. John G. Bergen contended strongly for the point as to the origin of the apples presented by Mr. Kimball, because he told him that was the way in which they were produced.

Mr. R. J. Dodge said he did not dispute the fact stated by Mr. Bergen, but did dispute the possibility of producing any such result.

Mr. Wm. S. Carpenter had investigated this matter, and thought and found what appeared to be the parent tree of this kind of apples; it grew in Putnam county, New York. A great many persons have obtained buds and grafts from that tree for the mere curiosity of growing apples which are both sweet and sour. The kind is now pretty thoroughly diffused over the country. The fruit is nearly worthless for anything but curiosity. He thought it had been proved that no two grafts from that tree produced apples exactly alike. The character of the fruit is very much owing to its exposure to the sun.

Mr. Solon Robinson.—Now, to put an end to this matter, I will here make this public proposition, that whoever will produce an apple by inserting the halves of two buds from sweet and sour trees, so distinctly marked that it shall be indisputably produced by such union, for instance, the sweet half shall be of a red apple, the sour half, a white, yellow, or green one, or showing any other characteristics of distinction which mark of the parent trees, I will pay the first producer of such apple \$100, whenever it is exhibited before this Club, with sufficient proof of the manner of budding and growth.

Mr. Wm. S. Carpenter said he would indorse this proposition, and Mr. Robinson said he would publish it in the reports of this meeting, as a standing offer open to all the world, to the first man who should make an exhibition of an apple which should answer

the requirements. We hope this will settle the sweet and sour apple question for the next five years at least.

The Chairman read an extract from a paper printed at Waterbury, Conn., stating that an apple tree belonging to Capt. Hackstaff, which until this year has always borne Peck's Pleasant, has now given a crop of Russets. This letter produced an abundance of talk, all to no purpose. The theory was that Peck's Pleasant had grown upon grafts, and the Russets upon sprouts of the original stock. Dr. J. V. C. Smith related a story of an apple tree, which he knew in his boyhood, with pendant limbs, which touched the ground and became partially covered by flowing or otherwise, and there took root and grew so firmly that finally the old tree was cut away, and thus the whole order of circulation of sap reversed. It is well known that the Banyan tree grows in the same way. I have seen quite a little forest which had spread out around one original trunk.

Sweet Corn—How to Preserve by Drying.

Mr. R. S. Todd, Junction, Kansas, thinks it idle to can sweet corn when it can be so much better preserved by drying. His directions are: Take the ears when in good condition for eating, pull off the husk and silk, and drop the ears one by one into boiling water, to remain only three minutes. Such corn cooks as quickly as an egg. Like an egg, it is hardened by long boiling. As soon as cooked, cut it off, and put it in the sun to dry. The last part of the drying may be done in an oven. It should be frequently stirred, and care taken that it does not sour, which it will do if spread too thickly.

Mr. R. J. Dodge said that a person who has had much experience prefers to boil the ears in the husk.

Mr. Solon Robinson said he had found by experience that cutting it off and drying without cooking, was decidedly preferable. It should be cut over a plate or pan, so as not to waste the juice and should be dried upon bright metal or earthen ware.

A New Potato Digger.

Mr. E. S. Lenox, Lincoln county, Maine, applied to the club to appoint a committee to see his potato digger in operation at Flatbush, Long Island, and Mr. Todd asked to have the same committee instructed to examine the work of Alden's improved horse hoe. Messrs. S. Edwards Todd and N. C. Meeker were appointed

the committee, and were instructed to add one or more Long Island farmers.

Mr. John G. Bergen objected to acting upon the committee, because, as he supposed, this examination was to test the comparative value of this machine with others made for the same purpose. As he has never seen any other at work, he should be unable to say this was the best. He also thought this committee, and all similar ones appointed to test agricultural implements, should be very careful in making reports that they do not recommend any that will not bear the test of actual practical work. The fault which he finds with all potato diggers is that they will not work in stony land, nor when the vines are green, or the ground obstructed with weeds. This seems to be the report of several which have been tried within a year or two upon Long Island. Such machines will not answer the purpose of farmers who raise a crop for early marketing.

Mr. Wm. S. Carpenter said a potato digger would not answer in his fields, but the plow will. He grew a thousand bushels this year, and found that by running a plow through the hills that it saved about one-half the labor of digging.

The Greeley Prize for Grapes.

Mr. Wm. S. Carpenter announced that the prize of $100, offered by Horace Greeley, for the best grape for general cultivation, has been awarded to the Concord; and as Wm. H. Goldsmith, of Newark, N. J., made the best exhibition of this variety at the late fruit show of the Institute, the prize has been awarded to him. The announcement of the fact that the Concord was the favorite elicited unanimous applause.

Quinces—A New Use For.

The subject alluded to three weeks ago, of *quince wine*, made by Mr. Henry A. Graef, Brooklyn, N. Y., was referred to a committee of physicians, chemists and experts. Their report, in brief, is, that having examined the formula by which Mr. Graef makes the compound, which he calls "Cidonia Bitters," they find nothing in it which may not be taken medicinally, in small quantities, in all cases where tonics are used, while it is evident to the taste of any one who tries it as the committee did, in comparison with a dozen other sorts, that it is the most pleasant of any one, and particularly well adapted to use in wine. The committee are also

satisfied that wine of quinces is a wholesome beverage, and as this new use for them will increase their market value, their increased cultivation is recommended.

Cabbage—How to Winter.

Mr. Solon Robinson.—A correspondent asks us the best method of preserving cabbage during the winter.

Mr. P. T. Quinn.—The method of preserving celery, described last week, will preserve cabbage. It is also preserved as follows, where the heads only are wanting: It is pulled with all the leaves attached, which are folded closely around the head, and that is placed upon the ground, making a compact row, in some place where surface water will run off freely. It needs two hands, one to hold the cabbage with the roots up, while the other throws up dirt enough to hold it in place. When the row is set, if convenient, you may turn a deep furrow each side, or else dig trenches, throwing the dirt over the cabbages, so as to cover all but the roots. Beat the ridge solid and smooth. The disadvantage of this plan is, you cannot get your cabbage out in mid-winter. For daily use you can keep some fresh and good, by planting the roots the whole length of the stalk, in a trench in the cellar.

Wine Vinegar.

Mr. Nelson Hatch, Holley, N. Y.—"Will the Club please give me directions for making grape juice into vinegar?"

Mr. Solon Robinson.—The same process that will make vinegar of cider will make it of grape juice, unless it is very weak in saccharum, as it often is when the fruit is not fully ripened. In that case it will require the addition of sugar. Its conversion into vinegar will also be hastened by adding a little yeast. In all vinegar-making, bear in mind that the liquid must be fully exposed to the atmosphere. It is the combination of oxygen with it that converts it into vinegar. The conversion is véry rapid when leached through straw or shavings, or dripped a long distance through the air, in a warm room.

Pear-Growing in Illinois.

Mr. E. A. Dudley writes from Fern Bluff, near Quincy, Ill., an assurance that the pears which were exhibited to the Club some time since were undoubtedly all Seckels, notwithstanding their

yellow russet color and unusual size. The trees exhibit all the Seckel characteristics, except perhaps in their productiveness, the branches being loaded with clusters of fruit. I should have stated that these pears were all of them the product of dwarf trees. I have other dwarfs in another part of my orchard one year older than these, and also standards, both of which produced very fine fruit, but of the Seckel color and not so large. Possibly a few hints, founded on my experience, may be useful and acceptable. I cultivate as early in the spring as the weather and the condition of the ground will allow—and let weeds and wild grass grow after about middle of July, using the scythe, if necessary, to prevent the wild growth from interfering with the lower branches.

My reasons for this are, first—to check late growth, that there may be no unripe wood at the close of the season. Second. It shades the bodies of the trees from the direct rays of the sun. The importance of this will be manifest on examination of the southwest side of the trees in almost any orchard in this part of the country. Third. It serves as a mulching over the entire surface of the ground, protecting the quince roots which were shallow in winter, and keeping back spring growth, and thus to some extent guarding against the danger from late frost—for the orchard ground is yet hard frozen, when the fields around are entirely free from frost and ice. The direction to cultivate thoroughly and succeed highly (as per cooks), will not do here, however proper it may be elsewhere. Too rank growth and unripe wood in the fall would be the result. The treatment is varied somewhat in different parts of my orchard, according to the richness of the soil. The point is to have a healthy growth, and not too rank, of ripe weed. Apply manure only where it is needed upon poor spots. Protection from north-west winds is highly important. I have lost more trees and fruit from the withering winds in April and May than I have from frost. After such winds, the blossoms wilt, fruit stems dry up and lose capacity to transmit nutriment. The orchard at this time looks like a meadow of dry timothy grass, and this appears to be the best condition to place it in for winter in this region. In case of blight, apply the knife behind the injured part. Let this work be thorough—aye, 'radical.' 'Conservative' treatment, however well and tenderly meant, will only prove delusive, and result in more general diffusion of disease throughout the body and branches. These hints are the leading points of 'my policy.' They would have been

valuable to me when I was without experience, and possibly they may prove beneficial to some who are, as I was, thrown upon their own resources, with everything to be learned."

Mr. P. T. Quinn replied that he was entirely sure that Mr. Dudley is mistaken, probably owing to double grafts, one producing Seckels and the other *Fondante d'Automne.* The system of cultivation which he recommends would not answer for this section of country. Whoever allows his pear orchard to become matted with grass will inevitably fail.

Mr. N. C. Meeker said whoever undertakes at Quincy to follow the instructions suited to pear culture in New Jersey or New England, will make a worse failure than Mr. Quinn would make by allowing his orchard to become as grassy as Mr. Dudley's. The soil there is so strong it is necessary to do something to check the growth of wood rather than encourage it.

Manure for Blackberries and Strawberries.

Mr. H. R. Smith, Tappan, Rockford county, N. Y., says: "I am preparing ground this fall for the purpose of setting blackberry and strawberry plants in the spring. Will backhouse manure and plaster be suitable manure for them, if so, how should it be applied?"

Mr. Solon Robinson—Such manure would be better for blackberries than strawberries. For the latter it would cause too rank a growth of foilage. Blackberries cannot be manured too highly, nor with manure that is too rank. For strawberries, a fine compost, or ashes, or bone dust, should be used. The contents of the privy should always be composted; with muck if convenient. It may then be applied on the surface near the blackberry plants.

Mr. Wm. S. Carpenter said he had had a good deal of experience in the use of such manure made into poudrette, the condition in which it should always be used. It is then suitable for strawberries or any other plant.

Cisterns—How to Build, and How to Stop Leaky Ones.

Mr. Joseph C. Shattuck, Linn Creek, Camden county, Mo.—"I want information about building cisterns, and mending leaky ones. I came from New Hampshire, where the abundance of soft spring water made cisterns useless. In traveling in this State, I have found many useless cisterns, apparently perfect, but would not hold water; was told the cement was not good. In Eastern Pennsylvania they build a thick wall with two feet of concrete for the

bottom. Is this necessary for a perfct cistern? In sinking one I should strike coarse gravel about a foot from the surface. Were I to plaster it with plastic slate, would it need as thick and carefully built wall as if cemented?

What is the best shape for one 14 feet deep, with an average diameter of five or six feet, considering that I am no mason myself and can get but poor workmen here? About how much cement or plaster will it take for a cistern of the above size, and how many brick for filtering partition to come to the top? I ask because all these I must freight from St. Louis at considerable cost, and have only a few opportunities in a year to get them at all.

Mr. Solon Robinson.—Cement, to be good and water-tight, must be mixed with as much water as it can be worked with. The sand must also be coarse and sharp. It is not necessary to build a thick concrete wall, nor any other wall. We have a good cistern plastered directly upon the earth. It is circular, the bottom dish-shaped, seventy-three feet deep, seven feet wide. Took three barrels of cement. If the gravel stands firm, you can plaster it. If not, make a concrete or brick-wall, barely thick enough to stand. Plaster it with water-lime or plastic slate; but mind you, not such plastic slate as is used for roofing. The coal tar for roofs *must not* be cooked; the tar for cisterns must be boiled until the pitch when cold is as brittle as glass. Then melt and add the slate flour until stiff enough to be used with a trowel. A cistern plastered with this will be tight and endure forever. The coat need not be over a quarter of an inch thick. Your leaky cisterns can be made tight in the same way. Probably a coat put on with a brush would do it. As slate mastic is a patented article, you cannot use it without license. Any Yankee who writes as you do can build a cistern. I would rather hire you at a venture than half who pretend to be masons. If you cannot get cement, build a cistern of wood. We built one twenty-five years ago, which still holds water. Staves made of pine plank jointed together, a bottom of the same, and hooped just enough to hold together, is all that is necessary. The bottom of the hole was then puddled with clay. Upon this soft bed the big tub was dropped. Clay was tamped around the sides, holding the staves as tightly together as though iron-hooped. Joyce's pump is good, but we prefer West's. Freezing does not kill it.

Discrimination of Nails — Why Called Sixpenny, Eightpenny, &c.

Mr. George Barney, Swanton, Vt., says: "Fifty years ago, or more, my father made nails to sell the early settlers in these parts. They were cut from plate by a machine worked by hand, and each nail separately headed by hand. He has told me they sold nails those days by count, not by weight, and the small nails were less in price per one hundred than large ones. So I conclude that in past generations in England that they sold one hundred small nails for four pence, and these took the name of fourpenny nails, one hundred eightpenny nails at eight pence, one hundred nails at ten pence, &c."

Mr. Nathaniel Richards, Biberry, Pa., thinks the name originated from the fact that a "fourpenny nail" weighs four pennyweights, and so on of the other denomination.

Mr. H. N. Gates, Buckhamstead, Conn.—I investigated this point some years ago, while in trade in Canada. The result of my investigation was that the name originated among the English nailors, who were paid so many pence per hundred, as the name indicates, for manufacturing wrought nails. Before the invention of cut nails, all nails were always sold in the British wholesale market by the hundred, and not by the thousand."

Mr. Wm. Soule, Dover Plains, New York, gives the following solution of this problem: "George P. Marsh, one of the best of American authorities in philology, says: ['Lectures on the English language' (1st series), page 184, note.] 'Sixpenny, eightpenny, tenpenny nails are nails of such sizes, that a thousand will weigh six, eight or ten pounds, and in this phrase, therefore, penny seems to be a corruption of pound.'"

Mr. John Jameson, Boyleston School, Boston, says: "I learned, many years ago, that it was because so many pence were paid for a given number; as fourpence for one hundred of a certain size, twenty pence for one hundred of another and much larger size, &c.

Mr. Samuel Scantlebury, Chicago, Ill.—I am a native of Sheffield, England, where nails are manufactured on a very large scale. When a little boy I was sent to the hardware stores for nails. They were then sold at retail, altogether by the hundred. Thus, for fourpenny, you got one hundred nails of the same length as our present fourpenny nails; for sixpence, eightpence, or tenpence, you received one hundred of sixpenny, eightpenny, or tenpenny nails, corresponding in length, etc., to the nails of the

present day, that are so designated. In large quantities they were sold by weight as they now are. I know whereof I speak, for I have been among nails in England and America all my life. And now a word or two about cut nails, may, perhaps, not be out of order. About the year 1808, I used to go past a factory with mysteriously shaded windows. In my boyish curiosity I discovered that cut finishing brads and tacks were made there. The brads differed but little from the finishing nails now in use, and the tacks were precisely of the same kind that are now universal. They must have been made by a very cheap and summary process, for they were then sold as low as fourpence sterling per bona fide thousand for the small sizes, say three or four ounce tacks of the present time. I mention these sizes because they were such as were used in my father's business. I knew the maker well; but how long he had been in the business I cannot say. His name was Enoch Dickinson; he was an old man when I was a little boy. All attempts in England to manufacture cut nails have failed. First, because the makers have tried to make them as much as possible like the wrought nails. Secondly, English carpenters will not use nails that will not clinch. Hence the abortive attempts of English manufacturers to make cut nails."

Mr. Geo. Taylor, Hammonton, N. J., who is also an Englishman, says: "Nails in my memory in England, have been sold by the tale or by the 100; different nails had different names, as sixpenny rose, sixpenny clouts, sixpenny town brads, sixpenny brads, sixpenny floor brads, sixpenny clasp and cut brads, and probably others that I have forgotten, and this method is used to this day."

Mr. Cato, Concord, N. H., says: "Each size received its name from the price per 100. Those sold for three pence, English currency, per 100, were called threepenny nails, and so on." The testimony of these last three witnesses is positive to the point, and we think satisfactory.

Mr. Solon Robinson.—The above evidence we think conclusive, that the origin of the term penny as applied to nails is, as stated, that they were made or sold at so much per hundred.

Autumn Leaves.

Miss A. M. Allen, Johnson, Vt., sends a collection of colored forest leaves, to remind the members of the club how beautifully nature provides ornaments for country houses. These leaves, carefully selected and tastefully arranged, may be glued upon a

very rough piece of carpenter work and thus make a beautiful picture frame. When arranged in a portfolio, they also afford pleasant amusement and instruction to children and often to adults.

Mr. Solon Robinson said that he had lately seen it stated that leaves could be prepared by some cheap process which would make them almost as tough as leather, and asked George Bartlett, who is a practical chemist, if this process was practicable.

Mr. George Bartlett said that parchment paper, which strongly resembles that made of skins, is made by soaking writing paper in diluted sulphuric acid. He thought the same process would probably toughen the leaves.

Mr. N. C. Meeker thought the plan would restore one of the lost arts, as he had read of garments made of fig leaves at a very early period of the world's history.

A lady member suggested that the sulphuric acid would impair the brilliant colors of the leaves.

Mr. Solon Robinson replied that even though this did occur, if they could be made tough by the cheap process of steeping them in dilute sulphuric acid, the process would make them useful for many purposes; for instance, take some of the large sized leaves, like those of sycamore, balm of Gilead, grape, or even burdock, and they could be used in place of cotton to make cheap, warm comforters for the beds of the poor. Adjourned.

October 30, 1866.

Mr. Nathan C. Ely in the chair; John W. Chambers, Secretary.

Seeds from Brazil.

Dr. Joseph Cooper, Reinhardt, Campinas, Brazil, sends a variety of seeds grown in that country, which may prove useful, particularly that of the "fat grass." He says "if that will not stand the frost of the North, I hope it will flourish in some part of the Southern States, and be useful to those of our beligerent brethren who are turning their swords into plowshares. The botanical name is *Tristegos Glutinous*, two varieties, red and white. Another of the kinds of seed sent is *Dolichus Tuberosus*, which is extensively cultivated in some parts of Brazil for the tuberous roots, sometimes obtaining the weight of fifty pounds and more. These, eaten raw, are considered wholesome and cooling. They are also grated and used instead of the cocoa nut for a kind of sweetmeat.

The best kind of tapioca is made from this tuber. Its taste raw is like chestnuts, but not so sweet. I am cultivating this plant. I do not think it belongs to the genus *Dolichus*, but probably is *Pachyrhyzias.* I am cultivating a great many plants common here which may prove useful in the United States, particularly beans; their name is legion."

Poultry—Information Wanted.

Mr. N. C. Meeker.—Here is a gentleman from Oneida county, who wants information about poultry keeping, whether the business can be successfully carried on upon a large scale.

Mr. Solon Robinson said that every attempt of that kind in this country had proved a lamentable failure.

Dr. Crowell said he had seen a very large establishment near Paris, which contained two hundred thousand young chickens at the time he visited it. These birds, old and young, were all fed upon maggots. Dead horses and other waste animal matter were procured in which the maggots were produced.

Another gentleman said he had lately seen it stated that this great French establishment, about which so much had been published, had proved as complete a failure as any which had been attempted in this country. A friend of his who had visited Paris the past season, exerted himself to find it without success.

The Secretary said that the last volume of the Transactions of the Royal Agricultural Society of England contains an extensive account of poultry breeding upon a large scale.

Mr. William S. Carpenter said Warren Leland keeps a thousand or more fowls together in Westchester county, which are fed upon oats from the Metropolitan Hotel; and that the poultry business is successful and profitable. A skillful man is employed to attend to it. Generally speaking, people keep too many cocks with their hens. I have only two for seventy hens, which are sufficient.

The Chairman made the following statement: I wintered twenty-four hens and two cocks. I have now about seventy hens and thirty ducks. The entire feed for all these fowls has cost thirty-two dollars. From January 6 to May 23, I received 1,744 eggs, the market value of which was fifty-seven dollars and eighteen cents, though none were sold. I used and gave away the whole. One man who was sick during that time, ate but little else, and thinks these eggs saved his life.

Mr. N. C. Meeker.—I have been traveling for seven years in

various parts of the Western States. During that time I have visited several poultry factories. Some of them had a fair start; the owners were encouraged. They have all failed. When confined the hens ate their chickens; when they had no chickens to eat, they ate one another. In all cases they ate the bottoms out of the pockets of the owners.

New Seedling Potatoes.

Mr. Wm. S. Carpenter exhibited ten sorts of Patterson's English seedlings, which he finds more productive than Goodrich, which are more so than old sorts. From four kinds planted June 15, he obtained from one pound of seed of each, thirty-six pounds; forty-five pounds; fifty-four pounds; forty-six pounds. Those giving the largest yield are the best potatoes.

Mr. S. Edwards Todd, from the committee appointed to examine certain implements, submitted the following reports:

Lenox's Potato Digger.

The main part of the digger is designed to be an attachment to the mowing machine, for the purpose of economizing machinery. The one exhibited was attached to the Clipper Mower. The finger bar and shoes are removed from the frame that is supported by the driving wheels, when the potato-digging apparatus is secured to the frame by bolts, so that the driver rides in the same seat when digging potatoes that supports him when the machine is mowing grass.

The portion of the digger that lifts the potatoes from the place where they grow, consists of a kind of scoop-plow made of plate steel, over which the earth and potatoes all rise and are received on a shaker made to vibrate as rapidly as the cutter bar of the mower when in motion. On each side of the scoop-plow at the forward end, there are two small steel plows which turn the soil away from the potatoes to be dug, thus leaving a narrow strip of ground in which the potatoes all remain until lifted with the scoop. By means of a lever, the driver can instantly elevate the digging apparatus so that it is suspended above the surface of the ground while driving from place to place. When in use, by means of two adjustable standards, the scoop can be set to run to any desired depth. At the forward end of the frame, two adjustable sweep-hooks are let down for gathering the green vines into a close compass directly over the hills. When the digger is put in motion,

the ridge of earth rises over the scoop-plow, and passes back vines, potatoes, and all on to the shaker, which separates the potatoes so effectually from the dirt that no more are covered with earth than are lost in mellow dirt when the digging is performed by hand. The committee managed this digger with their own hands, and found that it requires about the same degree of skill that is essential to run a mower or reaper. Where this digger was tested, the potato vines were so large, dead and dry, that they did clog a little, so that it was found advantageous to remove the loose vines by once drawing an iron rake over the rows. Notwithstanding this obstruction, the committee desire to express their approbation of the machine as a valuable labor-saving machine, which they regard as a triumphant success, needing only such slight modifications as further use in different soils and under various circumstances may show to be necessary. Such a modification would be the adjustment of the shaker so that the potatoes may not be scattered over so great a breadth of ground. The scoop-plow performs the task of lifting the potatoes in a most admirable manner; and we were not able to discover the necessity of any improvement in this part of the machine. The dirt and potatoes having once reached the grate or shaker, their separation is inevitable, its action is so rapid and violent. We removed the loose potatoes, and dug over the ground in several different places in search of potatoes below the passage of the plow; and we were pleased to find that the digger brought fully as many potatoes to the surface of the mellow soil as are lifted by any other manner of digging; and all the farmers present, most of whom grow potatoes quite extensively, conceded that the machine dug as clean as laborers with hand-tools.

Do you inquire how the digger will operate on stony ground? We answer, just as satisfactory as a mower will work where there are stone heaps, loose stones, snags, roots and stumps to mow over and around. Our judgment is, that this machine is destined to rank with the best and most valuable implements of the present day. With reference to the digger operating on foul land where the vines are large, tough and green, the committee can say nothing, as no such places were operated upon. The ground dug over was very favorable and clear.

Alden's Horse Hoe.

This implement is designed for performing a variety of operations with neatness and in a most expeditious manner, in the cultivation of almost every kind of hoed crops. A part of this implement has been in successful operation for several years past as a horse hoe for working among Indian corn and potatoes; but recently some new and excellent additions have been made to it, with a view of bringing out an implement that is adapted to the cultivation of rice, the young cotton plants, and almost everything else that is planted in check rows or drills. The implement is guided by thills, the rear ends of which serve as handles for holding it. There are several kinds of teeth, any or all of which may be removed at pleasure and others substituted, where the implement is employed at a different kind of work.

In order to adjust it for weeding carrots, or clearing and pulverizing the ground between rows often nips, a double-winged goose-foot steel tooth is secured to the middle of the frame of the hoe, which may be run one inch, two inches or three inches deep, cutting off the roots and weeds and grass, and leaving the soil as nearly level as practicable. To rig it for cultivating Indian corn, broom-corn, potatoes, or any other crops in drills, two other steel adjustable teeth are bolted to the frame in such a manner that the earth may be turned toward or away from the rows. These teeth were all removed, and a steel tooth of peculiar form, having broad steel wings, was attached, after which the implement was drawn along a row of celery so as to throw up a ridge of soil a foot or more high, for the purpose of blanching the celery. Then all these teeth were removed, and the rice-cultivating attachment bolted to the frame. This consisted of eight steel teeth in the form of the letter L, so arranged as to weed four rows of rice at one through. The teeth can be made to run one inch deep, or four inches deep, by means of gauge-wheels, which can be elevated or lowered at pleasure.

In order to test the efficiency of this implement for every purpose, four rows of small stakes were set sixteen inches apart, to represent rice drills, and the implement was worked back and forth between the rows, pulverizing the ground most thoroughly, and cutting up every weed and spire of grass within two inches of the stakes. The committee handled the implement with their own hands, and they desire to express their unqualified approba-

tion of the excellent efficiency of this hoe as a labor-saving farm implement of great value.

Oats Injurious to Sheep.

Mr. S. D. Whitehead, Licking county, Ohio, writes that the sheep-growers of this vicinity think that oats fed in the berry will kill sheep, but if fed in the straw they will not hurt them. What says the Farmers' Club to this?

Mr. N. C. Meeker said the way to feed sheep is to commence when there is a good stand of grass. Then there is no danger of feeding oats either threshed or in the straw.

Dr. Snodgrass.—The oat is too concentrated; the straw with the oat makes a more satisfactory food. It would be well for them to keep in mind that by heavy feeding they are gainers in wool as well as in mutton.

Mr. D. A. Covert, of New Jersey, said the ideas are erroneous that oats will kill sheep, if fed in any form. Corn will produce more wool than oats; but oats will produce more muscle than corn. Farmers feed too lightly. The injury arises from this source. He always feeds heavily, even to the amount of one quart of corn or oats per day ot one feeding for every sheep. He would feed one quart of good oats per head to breeding ewes. A fat sheep, he said, will yield more wool than a lean one.

Mr. Wm. S. Carpenter.—When sheep eat oats greedily, they are liable to get choked. They are better than corn for ewes. Corn produces the most wool.

Sheep Disease.

Mr. A. H. Coffin, Mansfield, Dutchess County, New York: "In answer to an inquiry about sheep disease, I will give my experience from which he and others may gather some hints. I lost, during the months of July and August last, twenty out of fifty-three lambs, by a disease something like the one he describes. They were attacked in different ways, some by swelling of the throat; some by a moderate relaxation of bowels; others no visible sign but dumpishness; these last would sometimes die in twelve hours. Some would linger along for two weeks. I gave them salt and sulphur in a trough smeared with tar; after attack, gave Epsom salts, ipecac, weak ley, herb tea, and everything I could think or hear of. Out of twenty-four attacked, we cured four only. I cut their ears, got but a drop of blood; gave two weak

ley, and the other two ipecac. All others treated in the same way died. I examined several after death, and found them differently affected. In some the manyplus or manyfolds would contain a dry, hard substance through which it appears impossible for anything to pass. I had noticed some of them swallowing gravel stones, and found them imbedded in this dry stuff in the manyplus, making it seem like the gizzard of a turkey, and supposed instinct taught them that the gravel might cut through. Others would appear all right there. All, however, were alike in one respect, their blood was all turned to water, so that in skinning, the water would follow the knife, and in cutting them open we would not find blood enough to stain our hands. The lungs of some had the appearance of a fringe around the edges, from half an inch to an inch deep, the liver generally very pale. I cut open the heart of one and found it filled with clotted blood. One fine Southdown got better under our treatment and appeared to want salt. I gave it a little, and next day it died. I studied Randall, but got very little satisfaction—nothing touching the case. I then procured Youatt, from which I learned of something similar in England, and in order to be as brief as possible, will refer the reader to pages 432, 435, 436 and 447, but the producing causes and duration of the disease before death seem to be different. I have had various opinions about the cause, but have finally concluded that they must have eaten some weed which has produced the derangement in the stomach, not laurel, for I have had that, and it operates very differently. The remainder of my lambs are healthy and doing well, and the old sheep seem perfectly healthy. Can any one give me any light on the subject?

Diseases of Cows—Casting the Withers—How to Cure.

Mr. C. Ingott, of Minnesota, who says he is an old man of considerable experience, wishes to give it for the benefit of those having cows suffering from this disease: "In the first place, if the cow is young and worth saving, she can be saved by proper attention, time and patience. The disease is not incurable, it is merely unpleasant to deal with. It does not follow that a cow once affected will be so again. Therefore never turn away a really good cow to fatten because she has once cast her withers. The following is the plan I pursue: I carefully wash the protruded part and return it. Sometimes this is difficult owing to much swelling, but patience will overcome the difficulty. I then put

one or two stitches, say an inch deep (strong fish line as good as any), in the vagina. It has frequently happened, in my experience, that when the protruded part had been unusually swollen and then returned, that there is less fear of a return, and the way in which I account for it is this, that when replaced it is too large to be easily cast, and the time it takes for reduction is sufficient to impart the necessary strength to retain it. A stitch in the back is frequently resorted to, but in my opinion not necessary; this practice tends to irritate, and denies to her sleep, the most important need required for her comfort and recovery. Should the stitches rot or give way, renew them until she is somewhat advanced, then, as a matter of course, all fear is over, and as I have before observed, if she be not improperly exposed and half starved, the trouble will cease. I give twice a day a little bran and shorts (water just enough to damp). The following excellent remedy should be regularly given: half ounce pulverized opium, two ounces pulverized copperas, both in a pint of whisky; a tablespoon full morning and evening (niter would be better but is more expensive), she will not refuse this in feed, and long before the mixture is exhausted she will have ceased to require further attention. Shortly after next calving, she may cut again, but it is erroneous to suppose that because a cow has cast her withers, she will always do so."

The Barometer—A New Theory.

Mr. L. H. Reynolds, Brockport, Monroe county, New York, has a new theory for observing the barometer. He says: "I have one hanging in my office that for five years has never deceived me. If it is going to rain, the top of the mercury column will become flattened or depressed, forming a cup more or less deep as the rain is to be longer or shorter in duration. When it is about to clear off, or while it continues dry, the top of the column will become convex. The changes occur always from six to twelve hours before the change in the weather, and apparently have no connection with the rise and fall of the mercury in the tube."

Mr. Solon Robinson.—We are glad to find from the above statement, that there is some possible way of making the barometer useful to farmers. We should like, however, to inquire if it would not be necessary to wear one or two extra pair of spectacles to enable him to discover this concavity or convexity.

This correspondent taxes credulity too much in asserting that the barometer will indicate the duration of a storm.

Adjourned.

November 6, 1866.

Prof. S. D. Tillman in the chair; John W. Chambers, Secretary.

Sorghum Culture in China.

The Chairman read an article upon sorghum culture, from a British Agricultural Journal, said to have been written by an American in China, detailing the mode of culture by the Chinese.

Mr. N. C. Meeker.—The article is interesting as a statistical paper, but quite useless to sorghum cultivators in this country, because they have gone entirely ahead of the Chinese.

The Illinois people could teach the Celestials how to grow cane and manufacture it. There are some good things in that paper, and some statements that are not true. One of these it the statement that there are two paper mills in this country, running entirely upon sorgo stalks for the stock of their paper.

There is one matter about the Chinese culture that should be heeded everywhere. That is the care they use to prevent hybridization. The seed is liable to degenerate when near poorer sorts of sugar cane, or other varieties of sorghum, such as broom corn, Guinea-corn, Doura-corn, and some say with Indian corn. The Chinese method of saving sorgo seed should be followed here. They select the best heads, which are cut wi h two feet of the stalk, tied in small bundles and hung up to cure in a dry place.

A New Fuel.

Mr. Colvert, New York city, called the attention of the Club to specimens of a new fuel, or new way to utilize coal dust. He mixes ten per cent. of asphaltum and petroleum with ninety per cent. of coal dust, and presses it into cakes, by any convenient method, making them as solid and more combustible than anthracite. A letter from E. C. Bissell, Winnebaug Mills, Connecticut, indorses this composition as a valuable fuel. One of its advantages, Mr. Colvert contends, will be in compact storage on ship board. He estimates the cost of manufacture at the mines, where coal dust is valueless, at $2 a ton.

Mr. Solon Robinson said, then it will cost $5 a ton, with freight added. Can it compete with coal?

Mr. H. P. Smith said "coal dust now was not wasted as formerly, by coal merchants. It is worth $1.50 to $2 a ton in New England, where manufacturers have learned to burn it, without any preparation. I burn a good deal of coal for manufacturing purposes, and have learned how to do it economically. There is a great waste wherever it is used. I know families that use ten or fifteen tons a year, under precisely the same circumstances as with others who only use five tons. In the latter case, all the coal is burned. The cinders are sifted from the ashes, over and over, and returned to the fire, until almost everything is consumed. Even the ashes, if wetted and placed upon a hot coal fire, seem to ignite and burn so as to leave but a small residuum. In regard to this new compound, to utilize coal dust, it appears to me the cost of manufacturing, as stated, is quite too high to make it a useful invention, since the finest coal can be burned under steam boilers without any preparation, and with a little attention, in ordinary stoves, by wetting and using it upon a hot coal fire.

Prof. Tillman said: "One of our members has invented a machine for pressing coal dust, which I hope will help to utilize it.

Mr. Solon Robinson.—Whatever the plan, it must be one that will not cost $2 a ton. My opinion is, that a small addition of clay and water will make the dust adhere with great pressure, and at such small cost as to be available. All but 25 cents a ton of the value of anthracite coal, where it is consumed, arises from labor, transportation, capital and profit. Sometimes it is loss to the dealer instead of profit. For family use, or in a furnace, I recommend mixing five to ten per cent of clay with coal dust, by dissolving the clay in water and wetting up the dust and packing it in an old box, barrel or keg. When dry, break up and use. If an iron cylinder which opened in halves, easily fastened together, was used, it could be packed full of the mixture, made solid by tamping; then open, turn out the charge, and refill.

Dr. J. V. C. Smith, gave an account of the immense waste of coal dust at the mines in England, where it is set on fire to get it out of the way. That cannot be done with anthracite dust. But through the district of bituminous mines, the night traveler is seldom out of sight of great fires. With my New England ideas of economy, this enormous waste of fuel caused sad reflections in a country where the poor suffer as they do in England for want of fire.

Mr. R. G. Pardee spoke of the enormous piles of coal which he

saw in Illinois, where an excellent quality underlies a vast area only sixty feet below the surface.

Mr. N. C. Meeker said some of it is excellent, but some was poor for household use, as it contained so much sulphur that when shut up in close stoves it was apt to explode.

Early Potatoes.

Mr. J. B. Updegraff, Downsville, Washington county, Maryland: "Which is the best, earliest, and most productive potato; and which is the best mode of culture, and best manure?"

Mr. Solon Robinson.—Goodrich, Early, Dykman, Buckeye, Early York, Early June, and several other sorts, are each said to be the best by those who grow them. No one sort is established as the best or most productive. The best mode of culture is to make your land rich by previous manuring, and deeply mellow by frequent plowing, and then cultivate flat. Salt, ashes, plaster, and bone dust, for top dressing are valuable manures.

How to Preserve Fox Grapes.

Mr. Isaac Hicks, North Hempstead, Long Island, gives the following as the mode he follows: "Squeeze the pulp from the skin; put it in a kettle with a little water. Boil slowly, and stir for fifteen minutes to loosen the seeds. Strain through a collander. Put the pulp again into the kettle, and add the skins with half a pound of sugar to each pound of fruit. When cooked, put up in sealed jars. Fox grapes are better than cultivated varieties for this purpose.

Mr. Solon Robinson recommends making the grapes into a jelly similar to currant or apple jelly, as preferable to the above mode of cooking.

Relic of an Extinct Monster.

Dr. J. V. C. Smith exhibited a fossil shark's tooth five by six inches in length and width, which he said, compared with teeth of sharks of the present day, would indicate this monster to have been more than a 100 feet in length. It was found fifteen miles from Richmond, Va. Fossil shark's teeth are also found at Gay Head, Mass., but these are seldom over two inches in length. The teeth of the sharks of our day are not often larger than my thumb nail, yet such an animal is large enough to consume a man. Estimating from that point, it is difficult to imagine the size of this

animal, or the enormous amount of food required to satisfy his ravenous appetite.

Paper Bonnets.

Mr. Colvert exhibited something new for the ladies, in the form of a paper bonnet, a French invention, sufficiently durable to answer the ephemeral purpose of this article of dress, and much cheaper than any other material. These bonnets are made of all colors, and quite as pretty as any other. We recommend our country friends who desire to follow the fashion, to procure suitable paper, cut it in strips and plait it like straws. They are also made shirred and corrugated. To make them water-proof, the paper is first dipped in water saturated with alum. Dr. Smith said men's hats are now made of *papier maché;* perhaps ladies' bonnets could be made in the same way.

Peach-Growing at the West.

Mr. E. M. Morrison, Noblesville, Hamilton county, Ind., proposes to try an experiment next spring in growing peaches, if the Club see no objection to the plan. He says: "I will set the trees eight feet apart, in rows sixteen feet apart. I will train them low, and fan-shaped. When winter comes, press the limbs together as compactly as possible, and cover them with corn fodder shocked around them, or other material to protect the buds from the winter as much as possible. I hope in this way to be able to raise peaches. Will I succeed? We protect grapes and other tender fruits to some extent on this plan, and as peaches are the greatest luxury in the fruit department, it is of much importance to come upon a plan to raise them with certainty, and cheaply.

Several members expressed the opinion that this plan would succeed.

Mr. Pardee spoke enthusiastically of the great profit of peach-growing in Illinois. He alluded to one peach orchard near Duquoin which produced $15,000 worth of peaches the present season. This is a greater sum than his whole farm would have sold for.

Mr. N. C. Meeker said such statements needed a little qualification. He had a peach orchard not far from that section which did not give him a peck of peaches from 1,500 trees. This crop is one of the most uncertain grown in that State. The very orchard spoken of by Mr. Pardee had remained barren for six years, and the owner intended to cut it down last spring, but it escaped destruction through lack of time to do so. The present crop was

an exception rather than the rule. Mr. Pardee speaks of the productiveness of apples in Southern Illinois. That is true, but they won't keep over winter.

Mr. George Bartlett.—It is generally understood that it requires the thermometer eighteen degrees below zero to kill peaches in the New England States. Mr. Pullen, of New Jersey, says that eight degrees below zero will kill them there. If the night is still those upon hills are most likely to escape injury. Hale's Early is the hardiest.

Clematis from Seed.

Mrs. M. Ingals, Muscatine, Iowa: I am very fond of fruits and flowers, the latter especially, and want to know enough about them to direct their cultivation. Will the seed of clematis germinate without bottom heat? I have tried various ways but all failed.

The Secretary said he had grown the seed of clematis the present season in open ground. Another member said that there were several varieties, some hardy, others not.

Grafting Grape-vines.

Mr. B. Phillips, Unionsville, Iowa, writes: "In the early spring of 1865 I grafted some cuttings from Concord vines into roots, of what is here called fox grape-vines. The most of them grew and flourished well, forming stout, healthy canes from twelve to fifteen feet long the first year. This, the second year, I pinched them back, in June and July, but find the length of cane from each to be sixty-five to eighty-three feet. We call this a remarkable growth. But what I wish more particularly to present for consideration of the club is that the fruit (for three of them produced fruit this year) is dissimilar to both slip and root, and has degenerated. To the eye the berry is the Concord; but the bunch materially differs from one produced from root or graft, the fruit being very sour. All three bearing vines contained precisely the same fruit. Now I wish to know if grafting grape-vines has universally the same result? If not, why in these instances? On this subject I am totally 'dumbfounded,' and hope for light from the club.'

Mr. R. G. Pardee.—The change noticed in the character of the grapes is not owing to the effect of the stock upon the graft. It is the stimulating and excessive growth of the vine which always deteriorates the quality of the Concord grape.

Paint for Farm Buildings.

Mr. B. Killian, Oswego city, asks: "Can the lime-wash paint you recommend be changed by the admixture of any cheap substance, to a brown or dark paint which will be equally as good?

Mr. Solon Robinson.—Either slate flour or hydraulic cement will make a stone color. Yellow ochre, Spanish brown, Venetian red, or any other cheap paint may be added to give the tint you desire.

Fence Posts.

Mr. J. R. Hosley, East Dixfield, Me., says: "If we must have such things, a very convenient portable fence may be made by taking a stone weighing about 100 pounds, drill a hole in it and insert an iron rod, setting it in cement, for posts. Then make a light picket fence, using two by three joists, and nailing the pickets about six inches apart. Bore a hole entirely through the under rail of the fence and half through the upper one. Set the stones in the ground enough to steady them. Slip the fence on the iron rods, and the thing is done. This is not a permanent fence. It is not stone-wall, but cattle will not jump over it unless they are unruly, and an occasional stake or prop will prevent their pushing it over by rubbing against it. It costs about seventy-five cents a rod. But I wish you would go ahead and teach the farmers to do without fences if you can. In Maine some of the best farms have been fenced and cross-fenced, until the fences occupy one-twentieth of the land; and if any one tells farmers to learn to do without fences he is in danger of becoming an inmate of a lunatic asylum.

Mr. H. P. Smith.—I think it would be too much trouble to set such posts. They would be too costly in some places, and not available in others, for there are vast districts which have no stone. What we need is an iron fence post, which will not cost over $1, which can be readily set with a crowbar, and stand sufficiently firm, answering equally for a portable or a permanent fence. Such a post I hope yet to see exhibited before this club. I have myself a plan in view which I think will answer.

A New Plow.

F. Volkman, No. 171 West Thirty-eighth street, New York city, presented drawings of a plow working on new principles. The forward part of the beam rests on a pair of light iron trucks, about two and a half feet wide, and one wheel of which runs in the furrow; and the coupling thereto is so ingenious that ease of

movement, and yet sufficient rigidity to do good work are secured. Like most inventions, it is difficult clearly to describe. The result of this arrangement is, that the plow requires no handles, and when forcibly lifted from the ground and thrown to one side in any direction, it returns immediately into the ground and continues to do good work. Trustworthy parties who have examined it, state that the laborer has nothing to do but to drive, even in turning round, which it does at a right angle or a circle, that he can run as many plows as he can drive teams, and that the draft is easy. It works as well on rough ground as any other plow; and on the prairies it must be valuable.

Tomatoes—How to Raise and Can.—Preserving Fruit and Vegetables.

Mr. S. Edwards Todd.—Some of the old members of the North American Phalanx, at Leedsville, New Jersey, are largely engaged in market gardening. The chief among the is these firm of J. & C. S. Bucklin. They turn their attention especially to tomatoes, and as they make them a specialty, and have an experience of twenty years, it will be useful to impart their methods.

They raise their own tomatoes. This year they had over twenty acres. The variety is the large Early Red; they have improved it by culture; it is two weeks earlier than any other. In the latter part of February hot beds are made of fresh manure, a pit being dug fifteen inches deep, and from six to eight inches wider than the boxes on which the sash are to be placed. The manure is hauled and thrown into the pit, while a man levels it with a fork and presses it down with the back. He must not step on it. When the pit is filled, the box or frame is placed on it, and pressed firmly with the foot. The manure is covered with rich, fine soil about six inches deep, and the frame is banked up front and rear.

Generally, the seed is sown immediately, and the glass put in place. The sashes hold fifty lights, six by eight, and are three feet ten inches wide, and five feet one-half inch long. The frames are large enough for three of these sash. The soil is kept moderately moist, though little water will be required. In about a week the seed will come up, when constant attention is required, and every day a little air. They have six hundred sash and two hundred frames, which are sufficient for eight acres.

When the plants are five or six inches high, they are thinned out in the rows, which are six inches apart, and hilled up two inches, so that new roots may start from the sides and become

stocky and strong. About the 1st of April they are transplanted into cold frames of the size of the hot ones. The ground having been spaded up the width of the boxes, made fine, and if necessary fertilized, eighty plants are placed in one frame and nicely cultivated. A vast amount of water is now required, and to supply it an engine is set to pumping it.

From May 7th to 15th is the final transplanting. First, the ground is suitably moistened. Pieces of sheet iron are made into short pipe, say four and a half inches in diameter at one end, and four inches at the other, which are pressed down around the plants, a little turn is given and the plants and soil come up together without in the least disturbing the roots. They have three hundred of these pipes, and two wagons are employed to haul them to the field; while one is going another is coming. The pipes are placed in holes prepared and then withdrawn. The tomatoes never droop in any kind of weather, nor is their growth checked. All kinds of plants are removed in this way, and even watermelons. The plan must be new to most if not all our readers, and its value is apparent. The plants are set four feet apart; the soil should be good and the cultivation thorough.

Meanwhile, more seed successively is sown, both in the hot-bed beds and cold frames, and also in open ground for late crops, till the 1st of June.

The price for the earliest tomatoes starts at $6 a bushel; in a few days they fall to $3, where they stay some time. When they fall to $1, no more are shipped, and canning commences. This is an important part of the business.

The building is 75x40, three stories high, of brick, with a basement, the floor of which is cemented, and here is a well, also a boiler and engine which cost $1,000.

The tomatoes are brought to the door in wagons, usually in bushel crates, made of strong boards, when they are dipped into tanks of water made hot by steam from the boiler. There they remain two minutes to loosen the skin. Then the crates are put on trucks and carried to tables where they are spread out and peeled by women, who put them in pails. Next they are poured into an enameled iron kettle, whence women dip the mushy fruit into cans. Then the cans are passed to workmen who solder them tight, when they are taken to other vats which hold two layers of one hundred cans each. They sink, steam is let on, and they boil twenty-five minutes. A shorter time is not safe, because they

pour off all the juice they can, which leaves them solid. They get about twelve cans from a bushel; if the juice remained they would get sixteen cans. Then they are placed in box trucks and wheeled to the store-room. About thirty women and ten men were employed. The proprietors do not permit any one beside themselves personally to attend to the boiling.

An acre of tomatoes for early market brings about $400, after that it produces 3,000 cans. The late ones yield from 5,000 to 6,000 cans to the acre, which, this year, are worth twenty cents each. The cost of putting up a can is about fifteen cents, including a two cent stamp. It is said to be a show of wisdom that a can of peaches worth sixty cents requires the same stamp. The whole of their early crop this year sold for $4,000.

In addition, the skins are rubbed on a coarse seive; the pulp passes through; it is sifted on a finer one, which takes out the seed, and the product is made into ketchup, which is said to be of better quality than if made of whole fruit. It sells from $15 to $18 a barrel. The juice which has been poured off is sweetened with molasses and made into vinegar. Finally, the skins are put into a wagon and used for manure; sometimes so much accumulates they cannot haul them off, and neighboring farmers are glad to take them away. You see there is not much left.

In connection, this firm cans many kinds of fruit and vegetables. We give their process; as the result of long experience it must be valuable:

Cherries.—The stems are pulled off, the cans filled cold, and into the vacancies are poured a syrup made of one pound of best white sugar and one pint of water; seal and boil fifteen minutes.

Peaches are boiled fifteen minutes. If a syrup is used the proportion is a pound to a quart.

Pears.—The same as peaches.

Strawberries are boiled one minute.

Blackberries are boiled fifteen minutes.

Peas are picked fresh in the morning, shelled, placed in a kettle, covered with water, and boiled five minutes. This they do by steam, a pipe passing into the kettle. Then they are put into the cans and boiled only *nine hours*. The best sort is the Champion of England.

Beans are picked fresh, cut up short, boiled like peas half an hour, the cans filled and boiled three hours.

Corn.—Truly this is delicious, and everybody wants to know

how to put it up. How good it is on a cold morning with potatoes, butter, buckwheat-cakes and pickles! Our friends have had many years of experience, and they have tried every way they could think of. One year they put up many thousand cans and succeeded well. The next year, by precisely the same method, they lost all, and there seemed nothing certain. At last they are able to give positive directions. They are as follows: "Let it alone."

Adjourned.

November 13, 1866.

Mr. Nathan C. Ely in the chair; Mr. John W. Chambers, Sec'y.

The Dishcloth Gourd.

Dr. J. V. C. Smith exhibited one of these natural dishcloths. It is simply a covering of the seeds of a gourd, which is much grown in Louisiana, Texas, &c., where it is called *torehon*. Its shape is somewhat like one grown here, known as vegetable marrow, from one to four feet in length like a club, with a small bulb at the end. When ripe it is beaten upon a block or stone until the shell is broken away and the seeds scattered, the fibrous network then appears like a net bag or Fez cap. This which I hold in my hand, I cut open, thus you see it appears like thickly interwoven fabric, a foot in length, and eight or nine inches in width. In countries where they grow, this netting is used for dishcloths, scrubbing-cloths, horsecloths, also in the bathroom for many other purposes. I hope the gourds can be grown here, for I am sure they would prove very useful. For that purpose, I have procured a few seeds, a couple of which I will give to each member present, who feels disposed to make a trial.

Mr. N. C. Meeker doubted whether they could be grown as far north as this. He had tried and failed in lat. 37°. There is no mistake in their value. One of these articles would outwear a dozen woven dishcloths. They are not only needed for that, but for making bonnets, very good looking ones too, not unlike those I often see on Broadway.

Mr. Solon Robinson said they grew as far north as Nashville, Tenn. I think they can be grown here by starting them in hotbeds giving the plants a warm Southern exposure.

Dr. Smith said a gentleman in this city had succeeded in ripening them, and intended to distribute the seeds, but his gardener thought them an acquisition and carried them off.

A New Fruit from Japan.

Mr. Wm. S. Carpenter exhibited several specimens of this fruit. It is neither apple, pear, nor quince, possibly a cross between them. It was grown from seed on Staten Island. It is not good to eat out of hand, but said to be excellent for cooking. As it has no name, it was suggested by some members to call it Pyrapome (pear apple).

Mr. Carpenter also exhibited some Bergen pears, now in perfection, and in quality equal to the Bartlett.

Mr. John G. Bergen said one of the peculiarities about this tree is that it retains its foliage longer than any other sort. It originated upon Long Island.

A New Potato Digger.

Mr. J. S. Patterson. Whitney Point, N. Y., exhibited a new potato digger. It is an iron stirrup hinged to the handle, and operates as a fulcrum. The fork being inserted into the ground behind a hill of patatoes the operator places his foot in the stirrup, pulls upon the top of the handle and throws out the whole contents of the hill. It is said to work rapidly, and we have no doubt, with one-half the labor by a fork without this attachment. It will also prove useful in garden work, particularly in hands not sufficiently strong to spade deeply in the ordinary way. The whole expense of the attachment need not exceed fifty cents. It can be applied to any fork and readily removed when not wanted.

Salt Marsh Turf.

Dr. Snodgrass presented a sample of salt marsh turf forwarded by A. P. Sharpe, Baltimore, for the purpose of getting the opinion of the club whether it will answer a good purpose for manure. It is one to two feet thick upon a white clay from which it separates easily. Mr. S. says: "I would like to know its value as manure. I have hauled some of it into my barn yard for the stock to break up and mix with manure, but do not know whether that is the proper plan. My place is situated around a creek or rather inlet from the bay into which the draining of a large tract of land enters. There is also a large tract of mud five or six feet deep, bare at low tide. Would that be serviceable? How should it be used? Is there any machine to facilitate gathering it? This material is abundant on the eastern shore, and if there is any virtue in it, would like to let the people know it. I thought of collecting a quantity of the mud and spreading it on the land this

winter, and then using time for the spring crops, but being as you know a novice in farming, would prefer getting the opinion of some one more experienced than myself in such matters. I have a large quantity of ashes, having a steam sawmill on the place, and would like to know whether they would be of any advantage mixed with the mud, as chemistry informs me that alkalies bring into play humus and other organic acids in decayed vegetable matter, and I am sure there is much of such matter mixed with the mud spoken of. Another thing I would like to know, and it is, whether the sawdust can be used as a manure. I tried some mixed with stable manure on my potatoes, and do not see that there is any difference between them and the pure manured ones. My soil is a sandy loam, with subsoil of clay. It is what is called 'white oak soil.' Timber; pine, oak and chestnut."

Mr. Solon Robinson.—This sample is valueless as manure, at least so nearly so that it would not pay for hauling half a mile. It is apparently nine-tenths sand. The fibres which hold it together seem to be those of soft marsh-grass, which is almost entirely worthless as manure. The black mud spoken of may be a different material, and really valuable. It would be much improved if composted with stable manure or any kind of animal matter, such as might be easily procured in Baltimore. It should be worked over several times and exposed to the atmosphere a year before using. I would not recommend mixing ashes with it, because they are more valuable applied alone. The sawdust may be composted with the mud. It is of very little value for manure, when used in its natural condition.

Tree Planting.

Dr. Peck exhibited acorns lately gathered from the surface where they had fallen among the leaves and had had begun to vegetate. The failures which have occurred in planting acorns have frequently arisen from burying them too deep. They need only a slight covering of leaves or leaf-mold. As they are so easily grown, Dr. Peck urged everybody who owned land to pay more attention to tree-planting. If children were taught how easily they can grow trees, they would be encouraged to plant the seeds, and thus make up a deficiency in timber which in many parts of the country begins to be seriously felt. Care is not needed to protect the young trees for one year only. In the first year, if bitten or broken off, the germ dies.

INSECTS—WHAT WILL DESTROY?

Mr. W. J. McGown, South Union, Kentucky: "We cultivate garden seeds largely. Insects are our great enemies. Their increase of late years is alarming. The reports of the club are read extensively with interest. Any remedy, therefore, which you can suggest for the extermination of these pests will be read with avidity. The soil hereabouts seems to be stocked the present season so full of their eggs that we anticipate an unusually large number of them next year. Lime is recommended as a manure; does it tend to diminish our insect enemies. It has been recommended by Solon Robinson to use salt; but that is worth 75 cents per bushel here, and lime 25 cents. Can we afford to use them?"

Mr. Solon Robinson.—We think not, unless that is the price of lime unslacked. We would not recommend salt at over 25 cents a bushel, except in a small way. We would encourage the discussion of this insect question. It is one of the most important that can be agitated by farmers. It is doubtful whether the whole country realizes one-tenth as much food as it would if not destroyed by insects in the field and rats in the granary.

Dr. Isaac P. Trimble.—I do not believe that lime or salt used as a manure is of the least value in destroying insects. Indeed I have tried the experiment repeatedly of placing several kinds of them in both salt and lime to undergo their transformation. It will not affect them while it remains dry. In the soil it is not in sufficient quantity, although wet, to produce any effect.

Prof. Tillman.—A friend of mine has lately tried bone charcoal which had been used in the process of clarifying petroleum. That being charged with some portion of the oil containing traces of sulphur, and probably also a small quantity of carbolic (phenic) acid, when applied to the land, either destroys or drives away all the insects. This phenic acid is one of the greatest disinfectants ever discovered. It is so offensive to mosquitoes as to serve as a perfect protection to a person. The bone-dust being a waste product can be used at little expense for ridding us of the pests which are so destructive to our crops.

Mr. John G. Bergen inquired how it would do to use gas lime as an insect remedy.

Dr. Trimble said it would have no effect unless used in such quantities to destroy vegetation.

Dr. J. V. C. Smith said coal oil may kill insects, so will any other oil or grease, even a drop upon a pin-point spread upon the

surface of the insect, closing the spiracles so as to paralyze action in that part upon which it is applied.

Mr. John G. Bergen thought that some insects were not affected by grease; for instance, those which live on cheese and bacon. Dr. Trimble said that whenever a bug or fly gets into the ear of a person, apply a drop of oil and the insect will immediately march out.

Mr. John Crane said gas lime was one of the best protections against borers he had ever found. He also tried it to keep bugs from vines. He applied it too thickly or too closely, and killed both. He then placed the line in a circle surrounding the melon hills and found that a complete protection.

Apple Worms.

Mr. L. Wright Pierpont, writes: I want to give the club a little of my experience about appletree worms. Last fall I read in the *Genesee Farmer* that earthing up trees in the fall would prevent injuries from mice. As I had lost trees the winter previous I thought I would try the experiment. Under the first tree I found a nest of young appletree worms about half grown. I continued the process under all my trees and found them in clusters, of about a small handful in a place, of various sizes and from one to five or six bunches under a tree. I then examined the trees on which they had been through the summer, and could find no nits or eggs from which it is generally thought they are hatched in the spring.

It has always been a mystery to me how appletree worms could hatch from an egg deposited on the tree in the fall and become a full grown worm as soon as the tree begins to leave out in the spring. Will the club investigate the subject and make report. With me the theory of an egg remaining on the tree all winter and hatching out so early in the spring has collapsed. Should any think otherwise please try the experiment, and watch the hatching operation through the winter and make report. But don't forget to spade up under your trees; it will pay whether you find the worms or not. My trees are of three years' standing. On spading them I find no worms: they are doing finely.

Now I am on the subject of worms I might as well say something about angleworms. For some twenty years or more they have infested my garden and some portion of the time have rendered it almost useless. Have applied salt, lime and ashes with

little or no benefit. For the last ten years I have practiced late fall and winter plowing, and thus have got the start of them some, and the land is improving.

The question is often asked, what do you think of fall plowing? I am in favor of it. For two years past I have practiced it with marked success. As soon in the spring as the ground becomes dry I harrow in my crops and the surface being well pulverized by the frosts of the winter, the land is in a good condition for stocking. Last year, on spring plowing, I had better kept my seed; but a neighbor of mine remarked that my oats, on fall plowing, were the only oats in town that were worth anything. Last spring I sowed on fall plowing and having sowed early I escaped the rust, consequently had a fine crop.

I want to say a few words about wintering sheep. I have a small farm, a short distance from my homested, which I devote to sheep, and on which I winter from 75 to 100 stock ewes. My method is to give them the liberty of the barn floor, stable and shed, having racks sufficient for feeding under cover, with doors open for entrance. I feed nothing but hay, and for two years past the sheep have come out in splendid condition, and doubled their number in lambs in the spring.

I want to inquire what is the best remedy for foot rot in sheep? One of my flocks have had it this summer. I have applied butter of antimony, also driven them through a solution containing oil of vitriol and slacked lime and have mixed a little sulphur and copperas with their food. They are apparently well and improving.

Hedges for the Prairies.

Mr. Solon Robinson.—A writer in *The Prairie Farmer* declares that he has "never seen a hedge of any description that is a fence against stock upon the prairie. When Osage orange was first introduced we were told that its thorns were so powerful and persuading that no stock of any description would go within yards of it. This was certainly a mistake. I have seen cows run and butt at a hedge now in my sight, breaking it down precisely as they do an evergreen when they have the chance. To such an extent was this carried that the owner was obliged to put up a wire fence outside to keep stock off, and now they poke their heads between these and browse upon it with perfect impunity. Having no plants to sell, nor any axes of any kind to grind for or against anybody, but simply to draw out the truth in this matter, I would ask of

your many intelligent correspondents if they know of a single hedge that is stock proof? After a full and patient trial of the Osage orange since its first introduction as a hedge plant, with careful observation of the success obtained by others with it in Iowa and Illinois, I am constrained to come to the conclusion that the hedge system is totally unsuited to our condition. I am satisfied that the expenditure of money in attempting to make hedges by our farmers out of the Osage orange is a complete waste of time, money, and labor. The money invested in attempts to make hedges, would have supplied every farmer with a fine sugar maple orchard, which would now yield enough sugar to furnish a full supply of this invaluable necessary."

Mr. N. C. Meeker said, this is one of the most important questions we can discuss. There are several States deeply interested in hedging. They have no other means of fencing the great prairies, It is a damage to the people of Illinois and Iowa to tell them that Osage orange will not make hedge. It will do so if properly treated in the first instance, and taken care of afterwards. If neglected the trees will grow thirty feet high. Like all other hedge plants, it needs constant care.

Mr. John Crane.—My brother fenced half a section of land in Henry county, Ill., with the Osage, which is a perfect fence against all stock. When the plants were two years old, they were frozen down to the ground. The dead brush was left standing, and made a partial fence, while the new shoots came up ten times as thick as the old ones, making the hedge closer and better. He has a ten-acre hog pasture fenced in this way, which holds the animals better than a board fence. Alongside an orchard, it has been left to grow untrimmed, and is there thirty feet high. It is a valuable wind-screen. A machine for trimming hedges has been invented, which will enable farmers to keep their hedges in order.

Mr. S. Edwards Todd.—There are miles of hedges in Onondaga county made of English hawthorn, which have been in existence more than forty years, and are perfect fences against all stock. The Osage orange winter kills in that locality.

Dr. Isaac P. Trimble.—I have known miles and miles of hawthorn hedges in Delaware and Pennsylvania, which, after serving the purpose some years, were destroyed by insects; first in gaps that were stopped by rails; then the intervening spaces of plants were neglected, grew unsightly, were abandoned for a time, and finally uprooted. Adjourned.

November 20, 1866.

Mr. Nathan C. Ely in the chair; Mr. John W. Chambers, Sec'y.

Osier Willow.

Mr. W. R. Prince, Flushing, sent twelve bunches of osier willow cuttings for distribution among the members of the club, which should be stuck out along the banks of rivers when there is danger of the soil being washed away. Mr. Prince sent also six golden Japan quinces for gratuitous distribution; also a very large green Japan quince, and some Osage orange seed. Besides these he sent one hundred tubers of the Chinese yam, which he proposes to show, by demonstration, to be the greatest agricultural boon from God to man.

Rhode Island Sweet Corn.

Mr. James B. Olcott, East Greenwich, R. I., forwarded two barrels of seed sweet corn for distribution among farmers and others.

He says: I think the variety the best in the world, and want everybody to have it. I think it ought to drive out every other variety. I have tested a dozen sorts, and marvel that people will eat such trash as some kinds are.

Storing and Handling Hay.

Mr. James B. Olcott says: The question of storing and handling hay is one upon which we need more discussion, greater light. The people further west have some good notions. Professional builders do not fully realize the necessities of the case. There undoubtedly is a form of internal arrangement for barns and stables—cheap, convenient and comfortable—to be worked up to after a world-full of costly experience. I say cheap, because by-and-by we shall learn to build durably—convenient, for that is cheaper—and comfortable, for both man and beast, for that is money saved. Shall we ever press our hay in bales before storing—thus altering the shape of our barns entirely? Will some one yet give us a tremendous "beater" fixture which shall stamp fifty tuns of hay into a tithe of the room we now give it?

Potatoes.

Mr. Wm. S. Carpenter exhibits the "Calico potato," one of Goodrich's seedlings, of which he speaks highly.

Mr. James P. Kelsey, Lancaster, Penn., recommends highly a new sort called Shaker Fancy potatoes. He obtained twenty-five

bushels from a half bushel of seed. The quality is so excellent I should like to know if it is so in other localities. With me they were superior to White Sprout, Harrison, Early Goodrich, Cusco, Garnet Chili, Buckeye, Peachblow and Monitor.

Salt for Cattle.

Mr. Daniel Stevens, Lawsonville, Lorain county, Ohio: I always give my cattle and horses plenty of salt. I do not feed over four quarts of grain per day to horses, unless they are working, then I give six. I also furnish my horses with sods in winter, as all domestic animals enjoy eating dirt. Salt I consider a necessity.

Mr. Wm. S. Carpenter.—I have some animals upon my farm which probably never tasted salt. I do not think it a necessity. My stock does as well without as with.

The Chairman thought it was because this farm was within the influence of the salt water.

Mr. Solon Robinson.—What then do you think of my case? When I lived near the head of Lake Michigan there was one winter a dearth of salt in the country. The farm stock generally had none for six months. My own never did better. I think that was the case generally. Up to that time I had been a great advocate of salting. Since, I have doubted its necessity.

Dr. Snodgrass thought it was necessary because animals are all fond of it. See how deer run after salt licks.

Mr. P. T. Quinn.—I am not satisfied that we can dispense with salt. I know if it is neglected my horses are apt to get off their feed.

Dr. Trimble.—There is no certain proof either way upon this question. There was a time when salt was a very scarce commodity west of the Alleghanies. Cattle brought from there often died, and I know the farmers of Chester county, Pa., thought it was not because they had not been accustomed to eating salt. Whether it is of any benefit or not, I should prefer to feed it to my stock for the mere pleasure of seeing them eat it.

Dr. Grant.—Cattle, when fed in winter upon dry up-land hay, really need but little salt, and as it increases their appetite for water in cold weather its advantages are doubtful.

Squankum Marl.

Mr. Solon Robinson.—I want to announce to the club that the power of steam machinery has been brought to operate in the busi-

ness of digging this invaluable fertilizer. A dredging machine takes the marl from a depth of 20 feet under water, and brings up enough to load a railroad car in less than one minute. These cars are upon a branch of the Delaware and Raritan Bay Railroad, and deliver their freight at any station, or on board of vessels at Port Monmouth.

Dr. Trimble.—These are not all the facilities needed to spread this cheap and excellent manure over the State of New Jersey. We must have tracks to connect the marl pits with all the railroads in the State.

Draining the Jersey Marshes.

This question was called up and discussed at some length, and then referred to a committee, consisting of Dr. Trimble, P. T. Quinn and Dr. Isaac M. Ward, who were requested to gather such information as will be useful to all owners of salt marsh.

Wire Fence.

Mr. A. C. Betts, Troy, N. Y., exhibited a specimen of wire fence requiring only four and a half pounds of number ten wire per rod. Permanent posts are set one rod apart. The wires are held in place by wooden strips, one inch in width and thickness, 15 inches apart, which gives it somewhat the look of a picket fen e. These strips are fastened to the wires with small staples, which are driven in very fast by a most ingenious and simple machine.

Hedges—Norway Spruce.

Mr. J. Pollard, South Wilson, Niagara county, N. Y.: "I want to know where to obtain seeds of Norway spruce. I am convinced it will make a good hedge fence. The cones upon my trees have no seeds. I also want to know when to plant and how I can succeed in growing the seed."

Mr. William S. Carpenter.—The growing of Norway spruce from seed is not generally successful. They only succeed in certain localities. Those furnish the young plants. I planted two pounds of seed one year, but got no plants. They were apparently all killed by the sun. The seed can be obtained at any large seed store.

New Mode of Training Grapes.

Mr. H. L. Salsbury, Holley, Orleans county, N. Y., says: "A new mode of training grape-vines has been started here. A vine is trained to a stalk five feet high, more or less, a main stake which is to be the central pillar and principal support of the structure; from this stalk, laterals are made to descend to the ground where they take root and are thus braced, keeping upright the central cone. These laterals are eight in number, or more, four of them starting two feet from the ground and the remainder four from the top. The calculation is that when this fabric gets age enough (say eight years), it will stand without the help of the stake. Will this plan answer?

Dr. Grant.—This is not a new plan, nor is anything gained by this mode of training. The branches will start from all these canes and grow upward. So they would if they lay upon the ground. But something is wanted to support the new shoots which produce the fruit. It is a better plan to train the vine in a bow shape, without any stake.

Mr. John G. Bergen.—In California vines are successfully grown by allowing them to run upon the ground. I saw the same plan successfully pursued at Hammonton, N. J. Delaware vines are hard to strike root from cuttings. Mr. Scoles of Brooklyn informs me that if the cuttings are set in autumn, there is no difficulty about their striking root.

Mr. Wm. S. Carpenter said that was also true of the prairie rose and several other plants.

Agriculture in Denmark.

The Rev. Joshua Weaver, who has formerly been a regular attendant at the meetings of this club, is now in Denmark, where he has spent the summer. Our readers will be interested in a few extracts from his letter. "Many of the characteristics of these people are much to be admired. They are quiet, industrious, and especially cleanly. The farmers live mostly in one-story, thatched cottages, always neat, and nearly always with windows adorned with pots of flowers. The land is carefully tilled, even small patches by the roadside. Still, I cannot term them good farmers, since they do not know how to make their land yield abundantly. England supplies a market for everything. Rye is the principal grain. Wheat does not succeed well. The barley crop is large and excellent. So of oats; no Indian corn. Apples

and peaches seldom grow. Small fruits abundant, especially gooseberries. Flax is extensively grown and used. Table linen of the hotels is of the finest description. The flax is unlike ours, being shorter and finer. [That is due to thick sowing.] Butter is abundant and excellent. It is equal to best Orange county. I have not once seen a poor specimen, not even in the humblest cottage. If a man should undertake to peddle such milk as is sold in New York, he would find it desirable to emigrate immediately. One of the beauties of this country is the enforcement of laws. If that were the case with us what a delightful region we should have around New York. We should at least have pure milk. Denmark is careful of her forests. Every encouragement is given to planting trees. There are very few of natural growth in the kingdom. I have seen large forests in as regular rows as orchards. No man is allowed to cut trees without a permit. If such were the law with us many beautiful trees would escape wanton destruction. See how the rocky knolls around Fordham have been stripped. Formerly Denmark was largely fenced with stone walls. The people are growing sensible, and removing these fences and converting the stone into excellent McAdamized roads. Some of the stone walls which have been removed were over two hundred years old. In one instance I saw a beech tree eighteen feet in circumference growing out of one of these walls. The prevailing timber is beech, though there are oaks and ash. The summer weather is so cool that my customary winter clothing is comfortable, and I sleep nights under two or three blankets. That tells you why corn will not grow here—the nights are too cool."

Adjourned.

November 27, 1866.

Mr. Nathan C. Ely in the chair; John W. Chambers, secretary.

Wheat and Flour.

Among the articles on the table to-day were six small sacks of wheat, sent by Mr. Samuel B. Chandler, from St. Clair county, Ill., where they are known by the following names: White Tappahannock, Red May and Dhiels wheat. They are all winter varieties of great excellence. The Tappahannock wheat was grown by John Griffin, thirty-seven bushels per acre, ripe June 16. This is in the latitude of St. Louis.

Following the examination and talk about wheat, naturally arose a conversation about flour. Mr. Francis C. Treadwell, who was a

city baker nearly fifty years ago, propounded the following questions: "Can good, wholesome flour be made of unsound wheat? or, can good, wholesome bread be made of unsound, sour, musty flour?"

He stated that some of the flour used in this city during the war, to make army bread, was utterly unfit for human food, and was doubtless the cause of much sickness in the army. Of his own personal experience he spoke in positive terms, that good flour cannot be made of unsound wheat, and no art of the baker is sufficient to make wholesome bread of damaged flour. In this city there is no protection to the citizens from the cheating of dishonest millers or dealers in flour, nor from the rapacity of bakers, who are disposed to doctor bad flour and make it into bread.

Dr. J. V. C. Smith said it had long been known to medical men that much sickness arises from eating diseased bread, as well as meat and milk. It is a question of life and death for the people to discuss, that unsound grain and flour is not fit for food.

Mr. R. J. Dodge.—It is a remarkable fact that a New York brand of superfine is enough to condemn a barrel of flour as bad, the character of the inspection here has run so low.

Mr. F. C. Bradshaw.—I was for eighteen years in the flour trade in Boston, and I know from experience how hard it is to detect the tricks of dishonest millers until the flour is baked; for instance, when beans are ground with grown wheat. It is a common practice with flour-dealers, when a lot sours upon their hands, to send it to the cracker-baker's. I bought a loaf of bread last summer, which was eaten by my family and made every one sick.

Dr. Grant.—What is the difference between good superfine and "extra" flour?

Mr. F. C. Treadwell.—Extra amounts to nothing. If the wheat is good the coarse flour is just as good as extra fine. The latter may be a little the whitest. It used to require five bushels of wheat to make a barrel of good flour; now millers get a barrel from four bushels. They also mix bad wheat in small quantities with good wheat, and thus render it impossible to detect it in the flour, but its deleterious effect is felt in the bread. As to flour of white wheat it may be a trifle whiter; it is no better than red wheat.

Mr. John Harold.—As long ago as the age of Chaucer the diseases of people were ascribed to eating diseased grain. With good wheat and country mills we always have good wholesome flour, middlings and bran.

Mr. F. C. Bradshaw.—The country mills never attempt to grind so close as merchant mills. It is close grinding that injures flour. Good wholesome flour should have a slightly rough feel and lively look. Good flour cannot be made in a dull mill. Some flour that shows too many specks to pass inspection as superfine, is really better for use than the very whitest.

Self-Raking Attachment to Reaping Machines.

Mr. Solon Robinson.—In connection with the subject of wheat, I have to announce the request of F. Nishwitz, Williamsburgh, N. Y., to have this club appoint a committee to examine a new invention of his, which he hopes will prove a better self-raker attachment to reaping machines than any other yet discovered. It is to have a public trial to-morrow at Millington, Morris county, N. J., in a field of clover and weeds, which will exhibit the principle upon which the new plan works. I have examined the plan, and am highly impressed with the idea. From extensive observation in the field and a thorough examination of this subject at the great reaper trial at Auburn last July, I am well satisfied that a perfect self-raking machine is the greatest desideratum now sought by farmers. I therefore hope a committee will be appointed to examine this machine, and also a new earth pulverizer, a substitute for the harrow, which will be exhibited at the same time.

After some discussion upon the importance of this new invention, Solon Robinson, Mr. J. Crane, and Mr. S. E. Todd were appointed to examine and report at the next meeting of the club.

An Ice-House that Fails.

Mr. Benjamin Gardner, Covington, Fountain county, Ind., wants information about an ice-house, built at large expense, two years ago, that fails. "It is 16x16 feet outside, covered with dressed weather-boarding; has a space of two feet all around the house inside, which space is filled with tan bark; and the inside wall between the bark and ice is of inch oak boards not matched; the roof is of shingles. On the square of the house, under the eves, joists are laid, and a loose floor. There is a ventilator of wood, running up from the upper floor through the roof, 12 inches square; the house is above ground and has joists laid on the earth, and a plank loose floor which the ice rests on; there are double doors, front and back of the building, used in filling; when the house is filled the loose floor is laid down and between

it and the roof filled with straw; as the ice around the sides melts the space is filled with saw-dust; the house holds 50 wagon loads of ice, and fails of supplying two families, say by the first of September. There has been no expense spared in erecting the house, believing that it would keep an abundance the year round. My queries are, is tan-bark a non-conductor? Is there a better, cheap non-conductor? Ought there to be air admitted at the bottom of the ice-house, or ought all air to be excluded? Ought the ice to lie on a floor, or on the surface of the earth, or would it be advisable to make a cement, a grouted floor, to prevent any heat ascending from the earth? Which of the two is preferable to cover ice, saw-dust or straw? The air inside the house always feels sultry or hot. Can you tell me what is the matter?"

Mr. Solon Robinson.—My opinion is that the tan bark was put in wet, or has acquired moisture enough to cause it to pack, until it is not a porous mass, like straw, saw-dust, charcoal, &c., which will preserve ice whenever it is surrounded two feet thick. Else it melts from air coming in under the floor. Our great ice-houses are very cheaply built—mere shells—the prevention of melting comes from straw. The best filling in is charcoal dust; next, turners' chips or short shavings; next, saw-dust; next, straw, leaves, &c. The most perfect ice-house would be one absolutely air-tight, except the top ventilation; and that is only necessary when the ice is melting.

Mr. Wm. S. Carpenter.—My house is 14x14, as tight as possible up to the eaves. The door enters the gable, and there is a floor covered with one foot of straw. I pack the sides around and over the ice with chaff, six inches thick. I fill in between cakes with snow, to prevent any circulation of air.

Mr. E. Baldwin.—My ice house is much like Mr. Gardner's, except the walls are filled with planing-mill chips. My floor is stone, covered with straw, no floor above. I fill solid and ice keeps well.

Mr. R. J. Dodge.—Wet and decaying straw will cause ice to melt.

Mr. N. C. Meeker.—So will air getting in at the bottom, no matter how well the ice is packed above. If no air reaches the ice except at the top it will melt very slow.

Pear Culture—Are Glout Morceau's worth Growing?

This old question was revived in consequence of some of this variety being upon the table, of good size and fair quality.

These, said Mr. R. J. Dodge, were grown upon the sandy land of Long Island. They are entirely unreliable upon our clay land in Jersey.

Mr. John Harold.—And do not always prove good upon our Long Island soil. It is an unreliable sort anywhere, and this club when this or any other sort is brought before it, should honestly tell the people the truth.

Dr. Grant.—This variety requires the very highest culture, and then the fruit never reaches excellence upon a young tree. When aged, the tree is inclined to overbear, and the fruit must be thinned or it will not perfect itself.

Mr. John Crane.—It is a poor sort where I live, near Elizabeth, N. J. I think that nurserymen like to sell these trees, because they are such vigorous growers when young. People used to be cautioned not to buy any sort that is so sure to bring disappointment.

Seckel Pears.

Mr. E. A. Dudley writes from Fern Bluff, near Quincy, Ill., some further account of the pears which he forwarded to the club under the name of Seckel, and which several members pronounced Seckel in taste, but not in looks. Mr. D. says: "I have thought that you may, perhaps, be correct in your judgment, and that the decision of that question is one in which all fruit-eaters as well as fruit-growers would feel an interest. If, indeed, it should appear that this is a new variety, it will truly be a valuable acquisition. These trees have uniformly borne such fruit, from their first bearing, while other Seckel trees in other parts of the orchard have uniformly produced Seckels of the well known kind. The trees are hardy, stout, symmetrically shaped by nature, regular and abundant bearers; and the fruit, when seen on a clear day, with its rich golden russett and bronze colors under different degrees of light and shade, presents a picture of gorgeous beauty, far surpassing anything else in the orchard. Mr. Quinn thought some of the pears I sent were *Fondante d'Automne*. I assure him I plucked every one myself from the tree which bears this new style of Seckels. I intend next spring to graft cions from this tree upon one which bears Seckels that are not disputed. I would be glad of any suggestion that would aid me in prosecuting my purpose to learn if this be a new variety, as I am not a botanist. The trees which bore the pears I sent you are decidedly Seckel, and nothing else in any branch; and the *Fondante d'Au-*

tonne (of which I have 100 trees) were ripe and all gone two weeks before I gathered these Seckels for the club. So they could not have been Fondantes.

Do Birds ever Die?

Mr. S. M. Peck, South Hadley, writes to the club: "Do birds ever die? They are never found dead in the fields. What becomes of them? What says the Farmers' Club?"

Mr. S. Edwards Todd.—"No, birds never die! The dear little creatures are never permitted to taste the sweetness of dissolving nature, of which poets have so often sung. The whole career of the feathered songsters of the grove is a complete gauntlet, so thickly beset with brick-bats, bullets, arrows and bloodthirsty foes, that even the swift-winged humming bird has never been known to escape unharmed, and to continue to live until the little creature had nothing else to do but to lie down and die. The warbling blue bird, striving to cheer our hearts with his song, is always a target for every mean boy that can throw a stone, so that not a place in all our boasted land of liberty marks the spot where this beautiful bird has gone to rest in peace. The joyous bobolink never dies; for, before the delightful cadence of its cheerful song has echoed from the meadows, sweet with new mown hay, to the fields of golden grain, some fatal missile lays the songster low. Even the little "chippie," that cheers the plowman with its heaven born music, and gathers noxious insects all the day, is popped over, its little nest ruthlessly destroyed, and the young ones fall a prey to kites and hawks by day, and to a long category of nocturnal marauders. It seems as if the lark, shrill-voiced and loud, bright messenger of the morning; the Baltimore oriole, with its mellifluous notes; "sweet little bob," and scores of other harmless birds that are the farmer's and gardener's best friends, might be allowed to live and die in peace. But they never have been allowed to die! And even the eagle, proud emblem of our boasted republic, the very sight of which ought to inspire every philanthropist and every American heart with a laudable patriotism, is not permitted to die in peace! Perched on a silvery cloud, or floating on broad expanded wings over the abyss below, while apparently measuring the ample range beneath, heeding not the death that threatens him, from the cruel sportsman, who instinctively cocks his rifle that never misses the mark, the noble eagle, glory of our nation, is shot down, as if odious treason and rapine

had rendered him unfit to live. The "carrion old crow" is never allowed to die, even in this land of death. Because the Creator endowed him with a taste for eggs and chickens, relentless and unforgiving men and boys refuse to let him live and die.

"The way of birds is filled with slaughter, carnage and barbarity. Cruel and blood-thirsty foes follow the whole feathered tribe with instruments of death; and, before they have fairly spread their pinions to fly, or poured their first song from the mellow throat, they drop, are gone, and soon forgotten."

Will Deep Plowing Spoil Land?

Mrs. T. A. Frost, Indian River, Lewis county, N. Y., says; "I have an old pasture, gravelly loam and quite stony, which I wish to plow this fall, to plant in hops next spring. The old settlers say that deep plowing (six or seven inches), will spoil it. How deep for hops should I plow? Would it be better to seed with clover preparatory to planting hops? Will it pay to use salt at $4 per barrel?"

Mr. Solon Robinson.—No ground is fit for hop planting that is not plowed nearly twice as deep as you mention, although hops will grow where the soil is rich if skimmed over in the manner we presume it is by the old farmers who advise you not to plow deep; yet land that never has been plowed over two inches deep will not produce well the first season if turned over six. But it will be greatly benefited by plowing it four and subsoiling it six more. Next year turn it six inches, and run the subsoil plow six inches deeper still, and you will find that deep plowing has not spoiled your land, for land cannot be plowed too deep nor too often, though it is true it may be injured by plowing too deeply at first with a turning plow, which piles the cold subsoil so deeply upon the mold that some crops would be injured.

Clover would be a good preparation for hop ground. Probably it would not pay to use salt at that price for ordinary farming.

Adjourned.

December 4, 1866.

Prof. S. D. Tillman in the chair; John W. Chambers, Sec'y.

Fifer's Gang Plow.

Mr. E. H. Phillips exhibited a model of Fifer's patent gang-plow, manufactured at Trenton, New Jersey. A gang of plow-

shares and cultivator teeth, attached to a frame, and mounted upon two wheels, is so arranged that a driver sitting upon the seat guides two horses, which straddle a row of corn or potatoes, and work the ground upon each side. It is said to be a successful cotton cultivator. It looks like a useful labor-saving implement.

Brinkerhoff's Corn Shellers.

Mr. Jacob Brinkerhoff, Auburn, N. Y., exhibited one of his corn shellers, which we have frequently commended as one of the best, either for hand or horse power, yet invented. One man alone can shell eighty bushels of corn a day, and it comes from the machine clean and ready for the mill. Its action to-day was highly commended by all who witnessed the operation. It was, however, suggested that the machine be placed in the hands of some members who will give it a practical test upon the farm, and report results.

Improvement in Horse-shoeing.

Dr. Peck exhibited specimens of a new invention, now coming extensively into use in Boston, which bids fair to be of great use to tender-footed horses. It is also said to be such a relief to all horses working upon pavements that the city railroads of Boston are adopting the improvement extensively. It is a cushion of India rubber placed between the shoe and hoof, both cushion and shoe being fastened by the same nails. It is said to be not only a preventive of dirt and gravel getting under the shoe, but entirely prevents horses from baulking, and that the shoes will hold on firmer and longer with than without the cushion.

Great Improvement in Reaping Machines—A Perfect Self-Raker.

Mr. Solon Robinson.—I am pleased to report that the committee which went out to Morris county, N. J., to witness the trial of a new improvement of reaping machines, invented by F. Nishwitz, Williamsburgh, N. Y., manufacturer of the Monitor Mowing Machine, are perfectly satisfied with the operation of this new invention.

We cannot speak in too high terms, and believe that we do not, when we say that Mr. Nishwitz has discovered a method by which any common mowing machine, with forward cutter-bar, can be changed into a perfect self-raking reaper, in five minutes time, and be operated without any apparent increase of power, and withal

so simple that a boy ten years of age can make the change and do the work.

Its simplicity is wonderful. Its perfect action is astonishing. The mystery is, that the plan has not been before discovered. Of the large number of gentlemen present, no one doubts that this is the cheapest, simplest, completest self-raker ever invented.

Of course it has not been tried in grain. That had passed by before this idea was born. The machine we saw was the only one ever built, and it is all in the rough, incident to first efforts and new contrivances, with which to make experiments.

It was tried in a seed clover field, where the dead straw and weeds afforded a light swath, but enough to show very well how the machinery works. Beside the stuff thus gathered, oat straw was thrown on to make up gavels. These are discharged as often as desired, by a slight touch of the driver's foot. It is very easy to make the machine discharge itself, at intervals of sixteen feet, without any attention from the driver.

The gavels are laid compact and straight, six feet away from the standing grain; thus leaving a clear space for the next round. In being thrown off, the straw instead of being scattered, is compacted, so as to make the gavels in good shape for the binder.

In cutting grain, mixed with grass or weeds, the weeds are apt to settle to the bottom, leaving the dryest portion of the straw at top, as it lies on the platform. By the operation of this machine, these bunches are turned bottom up, so as to expose the greenest portion to the sun.

The cost of attaching this improvement to any mower or reaper now in use, including a liberal fee to the inventor, will not exceed fifty dollars. The whole will not weigh over two hundred and fifty pounds—probably not over two hundred.

All the machinery necessary to add to a mowing machine, to drive this new self-raking apparatus, is the pully that drives the ordinary reel. The reel does the raking. It is six and a half feet in diameter, has six sets of arms, in the cross-head of one of which are the rake-teeth. These clean the platform of all straw every round.

How this is done is no mystery to those who saw the machine operate, and we could describe it so it would be fully understood by our readers; but this we abstain from doing now, at the particular request of the inventor, until he can secure his rights by letters patent in Europe. We may say, however, that the new

invention is applicable to any kind of grain, whether long or short, or heavy or light, and will be admirable for gathering and bunching clover seed, or buckwheat.

A farmer, with one of these machines, can go into his grain field alone, and drive round and round, as easily as he does in his mowing lot. When he has cut as much grain as he desires, he may get down from his seat, and cast off the chain that drives the reel, unhook the platform, raise it from the cutter-bar, and drive away, leaving the reaper and raker part of the machine on the ground, and in five minutes from the time he dropped the last gavel, he may be mowing grass.

I have had considerable experience with reaping machines. I attended the great reaper trial at Auburn last summer, where I heard the talk of machine makers and farmers. I am greatly mistaken if this is not the greatest desideratum yet offered to grain growers. I firmly believe it is far superior to any other self-raking attachment ever invented.

Mr. Crane has lately been much among the grain farmers of Illinois, where he saw the want of such a machine as this. He says: "It cannot be spoken of in terms sufficiently high. It works to the entire satisfaction of everybody."

It is a satisfaction to the committee to feel that they will be able to make this invention known to farmers, and that the reports of this club will be the first to publish it to the world.

Wintering Potatoes.

Mr. Robert W. Clay, Olney, Ill.: "How shall I put up Irish potatoes to keep best over winter?" "Should they be buried immediately after being taken from the hills?"

Mr. P. T. Quinn.—I will say a word upon the question of wintering potatoes and other roots. The sooner the latter are put in the earth again after digging the better, and I am satisfied that with them as I know it is with carrots, if the dirt is put directly upon the roots they will keep better than they will if first covered with straw. If straw is necessary to prevent freezing, I would put it outside of the earth covering. Some roots—parsnips, for instance—will not keep well, unless mixed through and through with earth; sand is best.

Accumulating Power by Wind-Mills.

Mr. James Bush, Middle River, Madison county, Iowa, asks: "Why cannot a farmer accumulate power by a wind-mill; winding up weights when the wind blows, to be used in a calm time?"

Mr. Solon Robinson.—There is no doubt power can be thus accumulated. But is it necessary? With a good wind-mill a farmer could do all his work by a little forethought. If power is to be accumulated, perhaps water would be the easiest managed. Pump it up to a higher level to drive your machinery when the wind failed.

Mr. Lee thought dry sand would be much better than water. It can be elevated in the same way as grain, and then used to turn a wheel. It would have one advantage over water: there would be no trouble from frost.

Mr. S. Edwards Todd thought the thing impracticable; that sand would not be easily managed.

Dr. J. V. C. Smith said the idea was not a new one. It was in use fifty years ago, or more, in Massachusetts; only that shot was used instead of sand or water.

Prof. Tillman.—All these recommendations are very good, if farmers must use wind-mills. However ingenious contrivances may be for using wind power, it is the most expensive that a farmer can adopt. It would be far more economical and satisfactory for him to purchase a small steam engine, which is always trustworthy, less likely to get out of repair, and as easily managed as a wind-mill.

Hickory Nuts—How to Plant.

Mr. M. H. Nichols, Hancock, Delaware county, N. Y.: "How can we grow hickory nuts? They have been tried here and failed. The timber is much needed here."

Mr. Solon Robinson.—Gather the nuts when mature and dry enough to eat. They must not get entirely dry before they are planted, and must not be buried over half an inch deep, in wood mold, covered with leaves. Unless you can keep off the squirrels, rats and mice, you are in danger of losing your seed. It may be kept moist in sand or moss, till Spring.

Buckwheat—Is it Wholesome Food?

This question called up a very warm discussion. Dr. Peck took the initiative that it was most unwholesome food; that buckwheat

and pork had been the cause of more sickness than any other two articles of diet in America.

Dr. Smith thought that more people died from want of such food than by the use of it. It is said that it produces irritation of the skin. He believes that that is beneficial. In his case, he finds no food more digestible than buckwheat cakes.

Mr. Solon Robinson expressed the same opinion. He has suffered as much as any other individual with dyspepsia, and finds nothing that digests better than buckwheat cake and molasses.

Mr. Wm. S. Carpenter said two members of his family were dyspeptics, and no food agreed with them better than buckwheat. They generally improved in health while using that food.

Dr. Peck objects to it because it does not give stamina. It lacks the muscle-making element.

Prof. Tillman.—Then oat meal should be added to the diet, as it is said to be richer in that element than any other grain.

Mr. W. Lee said he had been a contractor upon public works, and that it was a common remark that the men from districts where buckwheat was the principal article of breadstuffs, were not worth much as laborers. They cannot endure toil like those fed upon wheat flour and lean meat.

Apples and Pears.

Mr. John Crane, Union, N. J., exhibited the Douine, Jonathan and Belmont apples, grown in Illinois, and the Belle et Bonne apple and Columbian pears grown upon his place in New Jersey. This pear he considers the best winter variety, and recommends all who are unfortunate enough to have Glout Morceau to graft them with Columbian.

The Belle et Bonne apple is what its name indicates: beautiful and good. The Illinois apples are principally remarkable for their variation from the same kind grown about here.

Mr. Wm. S. Carpenter remarked he had never seen such large specimens of Jonathan apple.

Mr. Crane said they were not selected for size, but taken just as they came. Adjourned.

December 11, 1866.

Mr. Nathan C. Ely in the chair; John W. Chambers, Sec'y.

Fruit from Salt Lake.

Dr. Lewis A. Sayer, on his journey from New York to San

Francisco, found a great show of fruit at Salt Lake. A specimen of Gloria Mundi apple, sent by him to the club, weighed twenty eight ounces. He writes: "I picked twenty-eight perfect apples from a stick twelve inches long, and the whole tree was almost as full in every part of it." Some grapes were also sent, but did not come in good order.

Knight's Seedling Pear.

Mr. P. T. Quinn presented a few specimens of this variety, which he recommended very highly as a great bearer, and which are delicious for eating from November first till February. The pears were fully equal to the far-famed Seckel.

Mr. Wm. S. Carpenter spoke in highest terms of the excellence of this specimen of winter fruit, and it was proposed to re-name the pear Quinn's Knight's Seedling, as Knight's Seedling does not designate any particular kind of fruit.

Inspection of Flour.

Mr. F. C. Treadwell offered the following preamble and resolution:

Whereas, about forty years ago, the city and county of New York had, under the protection of a law of the State, a standard grade of superfine flour, fully equal, if not superior to the standard of any other State in this Union; and, whereas, under the faithful enforcement of that law by John Brown, the inspector, the reputation of New York superfine flour was, from previous depression, raised above that of most of the other States, both at home and abroad; and, whereas, under the practical abolition and disuse of the inspection laws, the reputation of New York superfine flour has sunk to such a depth of degradation that sales of it in our own market are daily reported at less than half the price of good superfine flour from oth r S ates, and the declaration is publicly made by gentlemen from other States, that "It is a remarkable fact that a New York brand of superfine is enough to condemn a barrel of flour as bad;" and, to the end that the wheat of the farmers of the State of New York, as well as the flour made from it, may be raised to their former high rank and character; therefore, be it

Resolved, By the Farmers' Club of the American Institute, that a committee of five be appointed by the chair to consider and report to the club such measures as may be deemed needful to

restore the character of New York flour to its former high standing, and to protect the public health from the evil effects of deleterious or poisonous food. Also to prepare memorials to the Governor and Legislature for their consideration, and for such action and relief in the premises as they may be able to afford.

Dr. Snodgrass, in seconding the resolution, said this was one of the most important questions which can be discussed. It is important in a medical point of view. The profession of this city are well aware of the injurious effects produced by baker's bread. As the case now stands, millers and bakers are both charged with poisoning people. Let us see by the examination of this committee which, if either, is guilty. It is very certain that the character of New York flour cannot be run much lower.

The following committee was appointed: Mr. F. C. Treadwell, Mr. Solon Robinson, Dr. Snodgrass, Mr. W. S. Carpenter, Mr. S. Edwards Todd; and on motion of Dr. Snodgrass the Chairman, N. C. Ely, was added.

Dr. Peck suggested as a new employment for women that they should study the art of making good bread: they might then become qualified to be good flour inspectors. It is a rather lamentable fact that there are many women who cannot make good bread, however good the flour is.

Dr. J. V. C. Smith inquires what effect does weevil upon wheat have upon the quality of flour? I was once employed by the Patent Office to purchase a cargo of Odessa wheat expected to arrive in Boston. I took the precaution, when the vessel came in, before making the purchase, to send a sample to Washington. An answer was immediately returned, thanking me for my caution, and directing me not to complete the purchase upon any consideration as the wheat was full of weevil. Yet that wheat was sold to millers, made into flour, and doubtless was all eaten. Is it not likely that is one of the sources of bad flour and unwholesome bread? Is there any way to distinguish flour made from such wheat?

Mr. Solon Robinson replied: It is distinguishable by a peculiar odor, particularly in hot bread. I have sometimes been necessitated to eat it, when this odor was actually nauseating. The flour has a yellowish appearance and clammy feeling. Some of the best wheat districts in the country, for instance, West Tennessee, are so affected with weevil as almost wholly to deter farmers from growing it. It is quite difficult to save the grain after it is har-

vested. It is sometimes put into casks or close bins, and the surface covered with flour of lime two inches deep. The lime is blown out when the wheat is wanted for use. Sunning the wheat before putting it up is an advantage.

Dr. Trimble said ships when once infested with weevil are unfit to receive another cargo. Barns, also, when infested, become unfit for storing wheat. This weevil is not a fly, but a beetle somewhat like the curculio or the pea-bug. There is one kind that infests pearl barley. These are so small that a dozen may exist in one grain.

Fence Posts.

Mr. Henry W. Clarke, Newport, R. I.: "I have patented an improvement in fence posts. My plan is to surround the post under ground to a depth below the frost, and extending upward about two inches above the surface, with a hollow frustum of a cone, having its greater base downward. The inside of said frustum to be filled with gravel, and top tightly closed around the post with some water-proof material. This prevents the frost acting upon the post and throwing it out. The frustums may be made of earthenware, water-tight, twenty-four inches long."

Mr. Wm. S. Carpenter said he had seen a recommendation for setting iron posts by making bricks with holes in them, and having the post run through two of these, and standing with the foot in a third, which would make a small iron post stand firm.

Mr. Enos Stevens said that one of the greatest causes of the decay of wooden posts which generally fail right at the surface, arises from allowing grass to grow in contact with the wood. Grass has a remarkable power of digesting dead wood; some kinds will use it up in two or three years. So will buckwheat. Railroad ties decay rapidly where grass grows around them.

Mr. John Crane, Union, N. J.—There is a fence in my neighborhood, made with chestnut posts, which has stood firm over thirty years. Large holes were dug and filled several inches around the post with stones.

Dr. Hallock.—I know gate posts which have been planted a long time, and stand firmly, by filling the holes with broken stone, and then mixing water lime with sand and water to a consistence that would pour and fill up all the interstices. That is cheaper than the plan recommended by Mr. Clarke.

Mr. Crane said that is the way Jerseymen set the posts of their hay barracks, which it is necessary should stand firm and straight.

Acorns for Distribution.

Mr. Wm. R. Prince, Flushing, L. I., sent for distribution acorns of the following named trees: Quercus Cerris—Turkish Oak. A splendid sub-evergreen tree, with beautiful foliage, and mossy cups to the acorns. It attains to the height of 80 feet. Quercus Pedunculata—Pedunculate Oak. A lofty tree, attaining to the height of 100 feet, with beautiful foliage, and bearing its acorns on long peduncles.

Paradise Stocks.

Mr. J. R. Neal, Croton, N. Y.—"Dwarf apple trees, I understand, are produced by grafting upon the Paradise and Ducian stocks. What are the Paradise and Ducian stocks?"

Mr. P. T. Quinn.—They are a species of European crab-apples, generally imported and kept by nurserymen for the purpose of dwarfing larger sorts.

Farmer's Revolver—Report of Committee on Agricultural Implements.

The committee which went to Millington, N. J., to look at the working of Nishwitz's improvement in reaping machines, had an opportunity of examining another important new invention of Mr. Nishwitz, a singular earth-worker. An appropriate name for it would be the *farmer's revolver*. It is a double-barreled six-shooter, and as effective an implement of husbandry as the revolver is of warfare. It is not a harrow, but it is a perfect substitute for that unsatisfactory implement. Suppose you imagine each of the twelve teeth in a triangular harrow, mounted upon a wheel twelve inches in diameter, you will then have an idea of the appearance of the farmer's revolver. These wheels being set upon an angle to the line of draft, their sharp, drill hardened edges, cut into the ground, turning it up like little plow-shares. It mellows the surface of a recently-turned sod better than any other implement the committee ever saw. It never tears up a sod as the harrow does, but it mellows and reverses the surface, putting it in a most admirable order for wheat. For covering wheat or any sowed grain it is an excellent implement, as it cannot draw it together as it does sometimes by the harrow. Unlike that, this, while it mellows the surface, does not pack the earth below. Made of a suitable size to work between the rows of hard crops, this revolver would be a great weed exterminator.

Grain and Seed Separator.

We also saw another valuable machine for wheat-growers, called the Uncle Sam grain and seed separator. Corn, wheat, clover seed and timothy are separated as readily as chaff can be blown from the grain. It also separates rye or oats from wheat, and Mr. Hyer, the inventor, offers to undertake to separate any kinds of seeds ever grown and mixed with wheat or other grain. The farmers present appeared delighted with the working of this machine.

Horse-Forks.

There was also exhibited a newly-invented horse-fork, acting upon different principles from any one heretofore in use. It is made of two slim bars of steel, which may be represented by supposing a man standing upon a load of hay with his feet crossed and close together, and his arms extended to the full length, slightly curved downward. Now, suppose another man seizes him by the shoulders and thrusts him down to his middle into the hay. In doing so his legs turn outward and his arms press down, reaching nearly to his toes. In this condition the fork is locked. Of course, it grasps and must lift a great burden of hay. When hoisted to its place it is easily tripped, and the prongs assume their original position, and are as easily thrust into the load as any harpoon fork, while the hold upon the hay is probably ten times greater.

This fork was approved by the Club, and is included among those which were tested at Rye by the committee whose report will be found in this volume.

Value of Sorghum.

Mr. Solon Robinson called attention to some stalks of sorghum grown on his land, in Westchester county, without any more manure or care than was given to Indian corn. I think the weight of the crop, four times that of an ordinary corn crop, as the stalks average twelve feet high, and stand more than twice as closely as corn. Now for its use, if not intended for making syrup. The little patch I grew was cut when mature, but not until after the first light frost; and when cured was taken to the barn, where, for some days my man has been feeding it to the cow and horse. We think it increases the flow and improves the quality of the milk. The horse has become so fond of it, that it has learned to distin-

guish the sound of the cutting-machine when it is cutting sorgo, and manifests greater impatience to be fed with it than it does for grain. As to its value, as compared with other feed, I am unable to say, but I think the feed crop may be very greatly increased by growing sorgo.

Mr. W. P. Peck, thought it was owing to its sweetness that the horse liked it. Horses, he said, are fond of sugar.

The Chairman stated that horses are exceedingly fond of molasses, and that saccharine matter fattens them rapidly.

Dr. Snodgrass said when animals consume too much saccharine matter, their flesh runs too much to cellular tissue. Too much sweet is not good for any kind of animals. Mothers injure their children, frequently, by giving them too much sweet. The flesh made by sweet food is usually too babby to be really healthy. Sugar does not produce strong muscular men nor animals.

Bird Houses.

Mr. George Bartlett, Hicksville, Long Island: "It is said that blue-birds and wrens are both attracted around farm houses if boxes are put up for them, but that the holes in the wren boxes must be so small that the blue-birds cannot get in, otherwise they will drive the wrens out. Now what I want to know is this: how large the holes should be for each of the two species; also, how large should be the holes of martin-boxes. I should like any other information in regard to the construction and arrangement of boxes for birds."

Mr. Solon Robinson.—A hole an inch in diameter will admit a wren, and will not admit a blue-bird. The hole for a blue-bird should be one and a half or two inches wide; and for a martin two inches wide, and three inches high. There should be a roosting-stick for the bird to light upon outside the hole. The cheapest and best boxes for wren or blue-birds are made of gourds, which are also cheap vessels for other purposes.

Dr. Trimble —There is a mistake in the statement about the blue-bird driving the wren from its nest. It is exactly the reverse. The wren will protect itself against any other bird. I have known it to annoy robins so that they had to leave their nests; and although a wren can go into an inch hole, it will not choose one so small on account of getting in their sticks. There is but one thing that I know of that can drive a wren from its box. Bumble-bees sometimes get possession of the old nest before

the birds are ready, and will not give it up. I have been trying for a number of years to ascertain if different birds always arrive upon a given day in spring. In the south part of Pennsylvania, the 22d of February is fixed for the time of the blue-bird, and the 17th of March for the Phebe-bird or peewit. That date wont answer for this locality.

The Chairman said that the holes of wren boxes should be so small that martins cannot get into them. They will certainly drive out the wrens.

Dr. Hallock.—The martins used to be very abundant in our neighborhood, but they have left that locality. What is the cause, and what shall I do to induce them to return?

Mr. Solon Robinson.—I think one of the main reasons was that they were charged with killing bees; and while they were under ban upon that charge many farmers pulled down their martin boxes, shot the birds, and hunted them away from the premises. I do not blame them for quitting the country. I would have done the same under similar circumstances.

The Chairman said he had induced them to come back by building them a handsome house. There was but one man in the neighborhood who had martins. The first year after I built my boxes the birds came occasionally during the summer and looked in. Next spring a deputation came early and held a consultation, and concluded to accept the new premises.

Blight in Black Raspberries.

Mr. J. R. Neal, Croton, N. Y.: Several years past I have been trying to cultivate the native black raspberry, but of late a disease, which I call a yellow blight, has attacked the bushes. Yellow fungus patches, nearly an eighth of an inch long, appear upon the under surface of the leaf, and destroying its vitality. Old canes thus attacked do not fruit, and young canes are quite sure to die before the end of the season. Is there any known remedy for the disease? Are the Doolittle's Black Cap, so highly recommended and other cultivated sorts, liable to this disease? The blight does not appear to be strictly infectious, for, while some canes will be affected, others in close proximity, and, if I mistake not, proceeding from the same root, will be healthy and entirely free from blight. I have never noticed the disease on wild bushes in the field—only upon the cultivated ones in my garden."

Mr. Solon Robinson.—So far as we know this is a new disease.

We have never heard of the Doolittle being thus affected. Dr. Peck, a mile north of Croton Station, has a valuable sort of black raspberries, which we believe have always been healthy.

Messrs. Carpenter and Quinn thought the disease came from a small red spider.

Shell Marl.

Mr. Almon Whiting, Harmonsburgh, Crawford county, Pa.: "I send you a specimen of marl which was taken from a bed or deposit of about 50 or 60 acres near this place. It makes excellent lime for building purposes when well burned. The marl is about four feet thick, overlaid with peat. This specimen was taken two feet below the surface. At the top of the bed it is in some places composed almost wholly of shells; the bottom is finer and heavier. Is this the kind of marl used as a fertilizer? If so, how, and to what soil is it adapted? I have used it upon wheat and corn, both in the crude state and burned, but find it must be used sparingly, else in hot, dry weather, it burns the crop. I see no difference in the effect between this and lime. We have many peat beds in this county, but I know of no other marl. This is at the head of Conneaut Lake."

The specimen sent is composed of small shells, univalves, which have existed at some period of the earth's history in fresh water ponds and lakes, and are now deposited in masses in various parts of the country. They are not only lime, but lime in a progressed state, which is, therefore, the more valuable for agricultural purposes. Such marl as the specimen sent is worth more per bushel to the farmer than lime made from rocks. It should be used in the same way and about the same quantity as you would use slacked lime, and that where it has been used to the best advantage is applied at about the rate of 30 bushels per acre upon small grain, when it is sown, every three or four years. We have never seen or heard of any soil where lime was not beneficial. If this marl was spread broadcast over Crawford county, it would double the crops in one year. It is one of the beneficent provisions of Providence, who has placed it there for the use of farmers. We are sorry that ignorance should prevent their availing themselves of its use.

Mr. Baldwin inquired how this marl differed from that known as Squankum marl.

Dr. Trimble.—It is an entirely different substance. This is nearly all lime, and would answer a good purpose in connection

with green sand marl. That has a considerable percentage of potash, and is one of the best natural fertilizing materials that exists in this country. The green sand marl is an actual fertilizer; this shell marl promotes fertility by its action as lime upon the inert matter in the soil.

The Ailanthus Tree.

Wm. S. West, Platsmouth, Nebraska: "Those who recommend the ailanthus tree are surely unacquainted with it. Its flowers are not handsome, its leaves come out too late in the spring, resemble the leaves of the sumac, larger, but not so handsome, stink all summer, and drop off early in the fall, leaving the tree about as beautiful as an old beanpole. Its roots extend to a great distance, and send up numerous sprouts, which are as difficult to exterminate as the Canada thistle."

Mr. Solon Robinson replied as follows: "It is you who are unacquainted with the ailanthus, at least you do not state the facts about its character. If its flowers are not handsome its seed pods are really beautiful. Its foliage does not stink. It is a remarkably sweet, pleasant, handsome tree, free from worms or bad odors, except during the blossoming season. Then, to some persons, its odor is quite unpleasant. Do you know, or will you learn how to prevent the blossoming? Prune your trees to a mere stump in autumn or spring. They will send out during the summer great bunches of sprouts, waving their long leaf stalks like an immense ostrich plume, or rather like the head of the palm-tree, which they will resemble. It will take these sprouts several years to acquire age enough to produce blossoms. When they do, prune again, and produce more young shoots. The limbs which you prune off, properly seasoned, are valuable firewood. The bodies furnish good lumber for cabinet-makers. They also make durable timber when seasoned. The ailanthus is a quick-growing, valuable tree for cities, where any other would perish from bad usage. It might be profitably and extensively cultivated upon western prairies. The man who says this is acquainted with it, and knows whereof he speaks."

Adjourned.

December 18, 1866.

Mr. Nathan C. Ely in the chair; John W. Chambers, Secretary.

Salt as Manure.

Dio Hughes, Pratt's Hollow, Madison county, N. Y., wants to know if he can afford to use salt at $2.50 per barrel, to kill daisies.

He also inquires what he shall do to renovate a field, situated upon a hill, where he cannot conveniently haul manure, and which hos been regularly mowed for thirty consecutive years.

Mr. Solon Robinson.—It is the opinion of those who have used salt most, that it would hardly pay to use it for killing daisies only, at that price. But combining two or three advantages together, it might be used. For instance, salt is of the greatest benefit to wheat. It ameliorates the soil, and renders inert matter available to the plants; and it has been proved in central New York that three bushels of salt per acre hastened the ripening of the wheat two or three weeks. For that purpose then, he can afford to use it.

The easiest way to renovate the field on the hill, which has been thirty years mowed, is to sow it with salt, lime or plaster, and not mow it for thirty months. Let the grass grow, and it will mulch and manure the ground.

Coal *vs.* Wood.

Mr. Hughes inquires which is the most economical, coal at ten dollars per ton, or wood at three dollars per cord, "stove length."

Several members inquired what was meant by "stove length."

Mr. Solon Robinson replied, sixteen inches, making the wood really nine dollars a cord. And one ton of anthracite coal is estimated to be equal, for domestic purposes, to three solid cords of hard wood.

Mr. P. T. Quinn said he had frequently noticed persons wetting coal, a practice he thought wrong, since all that water has to be driven off when the coal is put upon the fire before it will ignite. Solon Robinson replied that it was an advantage to wet fine coal, and particularly cinders.

Dr. J. V. C. Smith thought that wetting coal did not injure its heating properties, as the water is converted into steam, and wetting it is a great advantage sometimes in laying the dust.

BREAD MIXER.

The new bread mixer of Mr. J. M. Stanyan, Milford, N. H., which was mentioned, some time since, as having been referred to Mr. Solon Robinson for trial, he now reports has been used several weeks in his family, with entire satisfaction. The machine is a tin pan, having a wooden lid made tight by a rubber band. The materials for the bread being put into the pan, it is placed upon a pin on a standard, and made to revolve for a few minutes, which does the mixing.

A PRACTICAL QUESTION FOR FARMERS.

Mr. Isaac Eyre, Attleborough, Bucks county, Pennsylvania, asks: "Why is it easier for a team to pull a wagon loaded with a ton of hay than it is to pull the same weight of wood, coal, or iron, on the same wagon over the same road? I can carry upon my own shoulders a given weight of iron easier than an equal weight of hay; but when loaded upon a wagon, I know my horses pull the hay with greater ease."

Professor Tillman.—The only explanation that can be given of this well known fact in philosophy is, that the hay does not rest as iron does, a dead weight upon the axles. If the same load were pressed into compact bales, it would not ride easier than wood, and not much easier than iron. The loose hay acts in the same way that springs under a wagon would act. The elasticity buoys up and floats the load over obstructions. If hauled against the wind, its resistance would increase the draught, and make the labor of the horses greater than a solid load.

USE OF PUMPKINS AND PUMPKIN SEED.

Mr. Alexander Dale, Allegan, Allegan county, Mich.—"It is a perfect feast to me to read the proceedings of your club. Your club very properly discusses the subject of health. I will give you a simple, yet very valuable cure for inflammatory rheumatism. A woman's arm was swelled to an enormous size, and painfully inflamed. A poultice was made of stewed pumpkin, which was renewed every fifteen minutes, and in a short time produced a perfect cure. The fever drawn out by the poultices made them extremely offensive as they were taken off. I know a man cured of severe inflammation of the bowels by the same kind of application. I think such subjects as this proper for discussion in a farmers' club."

Dr. Snodgrass.—I have no doubt pumpkin makes a good poultice. Whatever holds water and warmth best is the most suitable.

Dr. Smith.—In my travels in Syria, I found pumpkin seeds almost universally eaten by the people on account of their supposed medicinal qualities. Not because they are diuretic, but as antidote against animalculæ which infest the bowels. They are sold in the streets as apples and nuts are here. It is a medical fact that persons have been cured of tape-worm by the use of pumpkin seeds. The outer skin being removed, the meats are bruised in a mortar into an oily, pasty mass. This is swallowed by the patient after fasting some hours, and it takes the place of chyle in the stomach, and the tape-worm lets go its hold of the membrane and becomes gorged with this substance, and in some measure probably torpid. Then a large dose of castor oil is administered and the worms are ejected before they are able to renew their hold.

Dr. S. gave a very interesting account of a missionary at Athens, Greece, who was cured by this simple remedy.

Dr. Trimble said it is supposed that bots in horses hold on with hooks upon the stomach in the same way, and that they let go when the horse is fed sweet apples.

What Shall we Eat?

Dr. Peck introduced this subject, and contended that physical regeneration must come through improvement in food. The best life insurance is good wholesome food, and plenty of it. The victims of cholera and typhoid fever are mainly those whose food is not nutritious or not sufficient. "Better pay the butcher than the doctor" is a wise maxim, but the farmers of this country don't like to pay either. Yet most families keep a private apothecary shop, and are constantly complaining of dyspepsia and bilious ailments. With many families the staple articles of food are pork, buckwheat cakes, pies and crullers cooked in boiling lard. In this State or New England it is difficult to find a middle-aged man or woman who is not more or less occupied in tinkering some chronic weakness or disease. They constantly violate physical laws, the punishment of which, though it may not be swift, is as certain as fate, and as cruel as the grave. The food question is therefore an important one for discussion. People must learn to live upon less pork, buckwheat cakes, butter and molasses, and eat bread that is not ruined by fermentation. Invest less in patent

medicines, and more in fresh meat and improved appliances for cooking.

Prof. Tillman.—Of all the cereals, buckwheat contains the greatest heating power, and scientists say, the least muscle-making material. Oats give the most of that, wheat next, and these rank highest as brain-making food.

Dr. Heallock.—What is wanted by man as well as the lower animals is a variety of food. If you confine a man to any one article he will not take enough to keep up the natural forces. If you feed a man upon coarse food, like corn bread and pork, he becomes coarse in his nature, and sinks down to a sort of animal existence. A man may live and drudge all his days upon poor food. You may often determine the character of a family by their very looks as well as the looks of their premises. Hog and hominy does not give refinement, and people generally do not think how much depends upon food. In short, many do not seem to know what they live for.

Mr. F. C. Treadwell.—In early times in New England, shad and salmon were so plenty that it was found necessary to stipulate in the indenture of apprentices that they should have meat, and not be exclusively confined to a fish diet.

Pork Barrels.

Mr. C. G. Cotting, Richmond, McHenry county, Ill.—"In one of the meetings of the club it was stated that pine will not answer for pork barrels. In this section it is considered first-rate. I have used pine barrels for salting beef and pork fifteen years. They are more durable than any other, but must be made of good sound stuff, free of sap. Many are of the opinion that it will spoil pork to salt it with beef. I have for the last three years salted my pork hams in the same pickle with my beef, and instead of hurting them, the beef actually improves the flavor of the hams. Some four years ago I thought I would try a single ham with my beef, and found it so much better than the ones I had pickled by themselves, that I have always pickled them with my beef since. I always salt my side-pork by itself, in a two-barrel pine cask."

Mr. Solon Robinson.—The whole error in the previous statement consisted in leaving out the word "new" before pine. That has often been known to give such an unpleasant taste to meat that it was not eatable.

The Manure Question.

Mr. Peter Brown, Simsbury, Conn.—"The great question with farmers in this section, is manure, and how to get it economically is a very important consideration; but that farmers must depend mainly upon the barn-yard, stables and hog-pens for cheap fertilizers, is an undisputed fact."

Mr. Solon Robinson.—The cheapest manure that you or any other man can use is clover seed, even at twenty-five dollars a bushel. Sow clover seed with every grain crop, even with Indian corn, and quit that worst of all practices—sowing oats upon corn stubble. Plow under a crop of clover to serve as manure for every other crop. Mix clover and timothy seed together, and if you get a good timothy sod, do not be afraid to break it up. It is equal to 160 loads of pretty good compost manure to every acre. In applying manure to your land, learn by actual experiment whether it is not more profitable to spread it upon grass sod and depend upon that to make corn, than it is to put the manure in corn hills.

Mr. Brown says further: "It is said it does not pay to fat pork here. Yet no one has kept an account. Hogs increase manure, and that pays for labor of feeding. If it is not a loss to feed grain, I should like to make more pork and more manure. Can any one give me definite information upon this important question? Many of the farmers in this section are feeding tallow scraps. Can any one tell the relative value with corn meal?"

Mr. Wm. S. Carpenter.—I have made some careful experiments upon this question. I find it advisable to feed the scraps and corn meal together. I am satisfied that ten pound of scrap are worth more than ten pounds of meal for either pigs or hens, and they do not cost as much.

The Chairman said, only about half price. I lately bought a cake of 400 pounds at one cent and a half per pound. This cake is placed in the poultry yard, where the hens can pick at it whenever they like. Sometimes portions are chopped off and broken up to enable them to eat it more freely.

Mr. Baldwin said, when bullocks' head can be obtained easily, they make good chicken feed, and the bones add to the manure.

A Fire-proof Roof.

Mr. James M. Allen, New York—"As the Farmers' Club has taken a deep interest in the question of plastic slate for roofing, and as the question has been mooted whether the roof is fire-proof or not, I send you a specimen from a burned building. You will perceive it is neither consumed, charred nor weakened. It was a soft mastic when the building took fire. Now it is solid, strong, and thoroughly petrified. The roof was upon a wooden lien-to against a brick building. It was so perfectly fire-proof, and so tightly joined to the brick that it prevented the smoke rising to blacken the wall above the junction. The super-heated steam and air could find no egress. The room was filled with most inflammable materials, yet with all the fire and heat none could escape through the roof. It hardened and stood until all support was burned away; when it fell, it broke into large sheets several feet square.

This burning has therefore proved plastic slate fire-proof. You will perceive, however, that the heat created gas in the soft substance which made it somewhat cellular, though hard and strong when cold. If the supports of the roof had been of iron, the slate would have remained, and formed a roof after the boards were burned away. This fire has proved that if wood floors were coated on the under side with plastic slate, it would prevent fire ever getting up through them. We are now satisfied that we can make felt so stuffed with slate that it can be used as a perfect fire-proof screen, either for roofs or for any other situation."

Madder.

Mr. Solon Robinson.—The club has received a number of communications in relation to the culture of madder. I have compiled the following from the best authorities:

Madder is grown in Holland, France and Turkey. It is a native of the Caucasian mountains, and roots brought from their forests grow well. The demand has slightly fallen off within a few years, owing to the discovery of dyes obtained from coal oil. Efforts are about to be made to have madder cultivated in this country. The value exported in 1864, was $838,872.

It requires a deep, dry and rich soil, with a mixture of chalk or lime. The roots are long, crawling, and divided into branches. In Holland it is propagated by shoots; in the south of France the seed is sown. The plants stand in drills, and the rows are about two feet apart. As they grow, the branches gradually are to be

covered with dirt, as in the case with peanuts, and from two to three years are required to mature a crop. When dug it is dried twice, ground in a mill, and exported; or an extract, called gurancine, which is a powder, is prepared. The yield is from 800 to 2,000 pounds an acre, and it is generally worth about 12½ cents a pound—sometimes it is much less.

Manufacturers long have urged its cultivation in this country. About twenty-five years ago several parties in Ohio grew it largely, but they found they could not compete with foreign labor, and they abandoned it. At present not a pound of American madder is reported in the New-York market. The general impression is, that our summers are not long enough. There are other difficulties. The choicest land is required; such land is full as profitable for broom corn, or even for potatoes. In addition, several years are required fully to learn how best to manage it—as is the case with all new crops, and to provide proper implements, mills and fixtures.

There is not the least doubt but there are many parts of our country where madder will grow well, as on the Illinois prairies, where sand gives the soil a reddish tinge, and also on all the secondary bottoms of the Mississippi country, comprising a vast area. Perhaps no soil or climate will better suit this plant than Kansas south of the Kaw river. On those upland prairies where the soil, two feet deep at least, undoubtedly is composed of decayed lime stone, this root must flourish better than in any other country on the globe. And yet, with this great opportunity, our people are tied hand and foot.

There is no duty on madder—it is on the free list. An American farmer, in growing madder, has a competitor whose wages is less than twenty-five cents a day; on this he has to board himself and to provide for his family. His dinner is a piece of black bread rubbed with an onion. Meat, tea, coffee, butter, poultry, seldom come to his table. Not for a moment will our farmers think of engaging in any industry which will place them on a level with European serfs. We have as much of this kind of business on hand already as we can manage. Our iron men struggle with the illiterate, sorrowful workmen of Wales; our manufacturers strive to make headway by paying a dollar a day for work which in England costs fifty cents, and our wool-growers, with high priced land, and with families needing education, clothing and good

homes, carry on a conflict with the savage flock-tenders of the paupers of South America.

If Congress wants madder raised in this country the only inducement they can offer is a duty or a bounty which will make the business profitable. Nothing is more absurd or unjust than the attempt of the freetrader to make the wages of a savage or ignorant people equal to the wages of a civilized people.

Dead Animals for Food.

Dr. Trimble stated that some people were accustomed to purchase dead horses for feeding their poultry, and sometimes the eggs of their fowls were offensive in consequence of their eating large quantities of such unwholesome food. He thinks no offensive food should ever be fed to laying hens, as bad food is liable to affect the quality of the eggs of the fowls that eat it.

Committee on Pears.

Mr. P. T. Quinn, Newark, N. J.. requested that a committee be appointed to examine a variety of winter pears which he presented, and to report at some future meeting of the club, whereupon W. S. Carpenter, Dr. E. Ware Sylvester, of Lyons, N. Y., and John Crane, New York, were designated as a committee, with unlimited authority, to report on the merits of that kind of pears.

Exterminating Brakes.

Mr. H. P. Smith, Westfield, Mass., gave his experience in exterminating brakes by draining the land thoroughly, and afterward sowing broadcast twenty-five bushels of quick lime per acre, which effectually exterminated these noxious plants, and brought in other plants that made the best of hay. It is still a disputed point whether good grass would or would not have appeared on that ground in the same abundance, without the application of lime, after the soil had been relieved of its surplus water. It is doubtful whether a thin sprinkling of lime will kill any kind of growing glants.

Culture of Roses.

Mr. J. S. Burgess, New York city, gave the following directions for raising roses:

Gather the hips when red, about October 25. Lay them in the sun in a window for ten days. Take out the seed and rub it well in the hands with moist sand, and be careful not to loose a seed,

as that may be the best for one of the plants which will be worth all the others. Dig a trench nine inches deep and a foot wide; then put in three inches of good well decayed cow, sheep or horse dung; then dig up the bottom a foot deep, and mix the manure with it. Return the soil taken out, pulverizing it thoroughly first, and walk over it once sideways, and smooth the surface with a rake.

Draw a drill two inches deep, and sow wood ashes just enough to cover the soil; then sow the seeds half an inch apart. Put on half an inch in depth of drift-sand from the roadside, fill in and rake even, and cover the surface with a board. The first week in April, on a sunny day, remove the board, prick up the soil with a fork or sharp stick, half an inch deep; then rake the ground over. Keep the ground clean, and stir up the soil round the plants three or four times. Some will bloom the first of July. Put a stout peg at each end of the rows. About the middle of October, on a cloudy day, take up the plants, prune the roots to six inches in length, and the tops to a foot. Prepare a piece of land as above, and plant them one foot by two feet apart. The first week in December, or before a hard frost occurs, make a cone of earth over each plant, nine inches high. About the last week in autumn cover with cedar brush or salt hay. The first week in April remove all the brush and head down to six inches in length. If the ground is not sufficiently moist, give the plants a liberal watering once a week.

The Dishcloth Gourd.

Mr. G. J. Brown, Morrisania, Westchester county, N. Y., writes to the club:

Seeing in the last report of your meetings something said concerning the so-called dishcloth gourd, and as it appeared to be doubted if it could be raised in this climate without artificial heat, I would say that I have raised it here in open ground from seed brought from New Orleans, without hotbed or any more care than is required for any other gourd, and that I am satisfied that, with plenty of room to run, (for it is a great climber,) planting about the time for Lima beans, it can be successfully raised in this climate. I send a few seed for distribution to any who may wish to grow them. The gourd is well adapted for covering up sheds, bare walls, or unsightly fences, as it requires no fastening.

Large Cotton Plants.

It may be of interest to you to know that I have raised upland cotton this year to a perfection in growth of stalk, above the average size, in sandy land, some of it being nearly five feet in height. The seed, however, was planted late in the season, and the early autumn frost injured the plants before the bolls had opened, although the earliest of them had attained full size. I propose to try cotton again next year, with fresh seed. The seed I planted last spring was grown before the commencement of our late civil war. By planting the seed earlier, I am confident of success, for I have never seen finer plants than mine were, except the cotton growing in certain places along the Mississippi river, on the deep alluvial soil. Cotton requires no great care when the plants are small. The main point is to sow an abundance of seed, and when the plants are four of five inches high thin out, as you would okra, and keep the hills well earthed up. This is all that is required."

Adjourned.

December 26, 1866.

Prof. S. D. Tillman in the chair. Mr. John W. Chambers, Sec'y.

The Chairman read an elaborate article by Prof. Frankland, London, upon the value of a great variety substances used as food, in producing muscular power for performing a given amount of labor. The following table exhibits the weight and cost of various articles of food required to be oxydized in the body, in order to raise 140 pounds to the height of 10,000 feet. The price in pence is for London; in cents for New York. External work equal to one-fifth of actual energy.

Name of food.	Weight in lbs. required.	Price per pound. s.	d.	Cents.	Cost. s.	d.
Oatmeal	1.281	0	2¾	5*a*6	0	3½
Flour	1.311	0	2¾	8*a*9	0	3¾
Peameal	1.335	0	3¼	not sold.	0	4½
Bread	2.345	0	2	8*a*10	0	4¾
Potatoes	5.068	0	1	1½*a*2	0	5¼
Ground rice	1.341	0	4 rice.	10	0	5½
Beef fat	0.555	0	10	25	0	5½
Grape sugar	1.537	0	3½ cane.	15	0	5½
Cheshire cheese	1.156	0	10	25	0	11½
Cabbage	12.020	0	1	1½	1	0¼
Cocoa nibs	0.735	1	6	None.	1	0¼

	Weight in lbs. required.	Price per pound. s.	d.	Cents.	Cost. s.	d.
Butter	0.693	1	6	56	1	0½
Hard-boiled egg	2.209	0	6½	32	1	2½
Carrots	9.685	0	1½	1	1	2½
Lump sugar	1.505	0	6	16	1	3
Milk	8.021	0	5 per qt.	10	1	3½
Arrowroot	1.287	1	0	20*a*25	1	3½
Cod liver oil	0.553	3	6	100	1	11¼
Mackerel	3.124	0	8	16	2	1
Lean beef	3.532	1	0	20	3	6½
Lean veal	4.300	1	0	25	4	3½
Lean ham, boiled	3.001	1	6	25	4	6
White of egg	8.745		6	--	4	4½
Isinglass	1.377	16	0	50	22	0½
Pale ale, 9 bottles, per bottle,			10	25	7	6

It will be seen by the above table that in point of cost, food which ranks highest in muscular force is least used in this country. The reason for that is, that, except in the present high rates of flour, oatmeal in New York has always ranked higher than wheat flour. In point of quantity, fat beef ranks the highest of any food, and cabbage the lowest. Milk, too, though food for babes, does not appear to give great muscular force. Potatoes, which are consumed in such large quantities by the poor, not only require a large bulk, but are really not an economical food. But of all the articles used to give strength, ale ranks lowest in force and highest in cost.

Dr. Sylvester.—A word upon this food question : When I lived in Georgia, the common price of broken rice was one cent a pound. It was largely fed to slaves, but always proved insufficient to give them muscular power. Rice as a food, is naturally constipating. It is found that feeding horses with rice dust tends to produce blindness.

Shovel Plough.

Mr. J. L. Butler exhibited a new implement invented by Cyrus H. Wooldridge, Venice, Madison county, Ill., which is now on its way to the Paris Exposition. It is the old shovel-plow improved —that is, constructed upon scientific principles, with a bar under the share running back to a standard, which will keep the plow in the furrow and avoid the tendency to jump. It will undoubtedly prove an invaluable implement far corn and cotton culture

Peabody's Improved Cotton Seed.

Mr. Charles A. Peabody, Columbus, Ga., after ten years' experimenting, has succeeded in producing an improved variety of long staple upland cotton, which for thread manufacturers has been found worth double that of the ordinary upland cotton.

Olcott's R. I. Sweet Corn.

On motion, it was resolved that the thanks of this club be and are hereby presented to Mr. Jno. B. Olcott, for two barrels of Rhode Island sweet corn, and a bag of early Narragansett corn which he has sent for distribution.

Verbena Seeds.

Messrs. Hubbard & Davis, Detroit, send to the club some verbena seed for distribution.

Osage Orange Hedges.

Mr. Theron P. Parker, Byron, Ogle county, Ill., "declares that a well cultivated, three year old hedge is a perfect fence against all stock. Cattle would as soon run through a blazing fire as through such a hedge."

Dr. Sylvester Lyons, Wayne county, N. Y.—I have a hedge of this plant on my farm, four years old. It is very beautiful in summer, but the expense of pruning makes it too costly for the generality of farmers.

Mr. Solon Robinson.—With proper implements it can be done very rapidly.

The Secretary said that a gentleman at Eatontown, N. J., has such a hedge surrounding his farm of one hundred and fifty acres, who informed him that it only cost him thirty dollars per annum to keep it in order.

Mr. John Crane.—My brother in Illinois, has an Osage hedge around forty acres. He does not think it as much work to keep it trimmed as to keep a board fence in order. The trimming is done with long blades fixed in stout wooden handles. There is a machine for trimming hedges.

Mr. P. T. Quinn.—I know an Osage hedge in New Jersey where one man trims forty rods per day.

Summer Pruning.

Mr. Theron P. Parker decidedly opposes. Cutting thistles and noxious plants at that season is recommended to kill them. Does not cutting apple trees tend to the same result? The entire top of one of my apple trees was broken off by accident in early spring. Yet in three years it had a top equal to those uninjured. If done in June or July, would the same result follow?

Mr. P. T. Quinn.—Mr. Parker's notions about summer pruning based upon cutting plants for the purpose of destroying them, have no application to pruning as it should be done; that is, to pinch off buds or cut away such shoots as can be easily removed with a knife. Such pruning never injures trees. It makes wood and fruit buds better than any other system.

Dr. Sylvester.—In Spring, the sap is not in as good condition to make wood and heal wounds as it is in summer. Large limbs when removed in spring, often turn black around the stump, as though scalded by the sun.

Hale's Early Peach.

Mr. P. T. Quinn.—This peach is two weeks earlier than any other sort grown in New Jersey. That makes it quite salable, although not quite as good as Malacatoon. There is a great demand for the trees in all nurseries. I know of one nursery of fourteen acres remarkably thrifty.

Mr. N. C. Meeker.—This peach is esteemed everywhere, as it is less likely to winter-kill than any other budded variety. Indeed it is much like a seedling in its character. The blossoms show light pink color, more like natural fruit. It is not as much stung by curculio as other early sorts.

Mr. John Crane.—I find Hale's Early George IVth, and in short all white sorts, more hardy than red or yellow. Honest John is a good peach, but on account of the smoothness of its skin, liable to curculio stings.

Report on Flour.

Mr. F. C. Treadwell, chairman of the committee lately appointed to prepare a report on good and poor flour, then made the following report:

Your committee have sought information from persons engaged in the flour trade, and have conversed with farmers, millers, merchants, dealers, bakers, and many persons interested in having a

reliable standard of superfine flour, and such a classification of other qualities or grades as shall enable purchasers to select the kinds they require.

The Revised Laws, published in the year 1836, compiled mainly from former laws, after prescribing the dimensions of the casks and the branding thereon of the quality of flour which each contains, and the name of the manufacturers thereof, provide:

SEC. 6. Every such cask of wheat flour shall be branded as follows: If of a very superior quality, "Extra Superfine;" if of a quality now branded "Superfine," with the word "Superfine;" if of a third quality, "Fine;" if of a fourth quality, "Fine Middlings;" if of a fifth quality, "Middlings;" if of a sixth quality, "Shipstuffs."

After referring to rye flour and Indian meal, the law provides:

SEC. 9. When the flour and meal has been packed, and the casks branded, according to the preceding provisions, application may be made to an inspector of flour and meal, and it shall be his duty to examine and determine the quality of the flour and meal.

SEC. 10. It shall be the duty of the inspector,

1st. To ascertain by examination the weight of all the casks which he may suspect of being falsely tared.

2d. To alter and correct the brands in all cases where he shall be of opinion that they do not designate the real quality of the flour and meal.

3d. To weigh such casks as he shall suspect not to contain the full weight, and if they do not contain the full weight, to brand them with the word "Light."

To brand all casks containing flour or meal, so damaged as not to be fit for exportation, with the word "Bad." And lastly, on all casks made, branded and packed according to the provisions of this article, to brand in a legible manner on the quarter, the initials of his christian name and of his surname at full length, together with the name of the county where the inspection has been made.

Your committee recommend that an inspector of flour for the city and county of New York, be appointed by the Governor with the consent of the Senate, as prescribed by the Revised and other statutes of New York, published in the year 1838; and that article first of title second of these statutes ("of the inspection of flour and meal") be taken and adopted generally as the law of the State, and to be enforced under the penalties therein provided.

With regard to the abolition of inspection laws generally by the Constitution of New York, adopted in the year 1846, the committee aver that the inspection laws respecting flour and the appointment of inspectors of flour have not been abolished, but have been virtually and substantially re-enacted and confirmed by that constitution. The same sentence which contains the supposed abolition, contains also the following provision, with nothing but a semi-colon between them: "But nothing in this section contained shall abrogate any office created for the purpose of protecting the public health, or the interests of the State in its property, revenue, tolls or purchases, or of supplying the people with correct standards of weights and measures, or shall prevent the creation of any office for such purposes hereafter."

Hence the laws in relation to provisions, to meats, to grain, to flour and meal, and to bread, and for the appointment of inspectors of those articles, are neither abolished nor abrogated, but are liable to be, and ought now to be, strictly enforced.

F. C. TREADWELL, Sr.,
SOLON ROBINSON,
J. E. SNODGRASS,
S. EDWARDS TODD,
NATHAN C. ELY,
W. S. CARPENTER.

Dr. Snodgrass suggested that the committee be continued, and be requested to persevere in their efforts to expose the impositions in adulterating the flour that is sold in our city markets.

The Quinn Pear.

Dr. E. Ware Sylvester, chairman of the committee to prepare a report on the Quinn pear, read the following description of this new variety:

"The committee on the Quinn Knight pear (which had received its name by a vote of the Farmers' Club at a previous meeting), respectfully report:

That they have examined the pears, and the trees upon which they grew. The tree was imported by the late Professor Mapes about sixteen years since, without a name, being labeled as one of Knight's seedlings. It was placed in the front yard among the evergreens, and has not received the care usually bestowed upon fruit trees, yet it has made a fair growth.

The fruit is below medium size, the larger specimens measuring six inches in circumference, shape pyriform, tapering rapidly toward the stem end; calix shallow inserted in a regular basin; skin thick, inclined to golden russet. The pears are in good perfection now (Christmas), and Mr. Quinn thinks its season is from the first of November to the middle of January with ordinary care. They are rich and juicy, free from grits, and in flavor and aroma, occupy the first rank. It is, in fact, a Winter Seckel; and if on trial it shall prove adapted to our climate, it will be a very valuable acquisition to our winter pears."

Mr. Quinn objected to the motion to rescend a part of the name, inasmuch as he was not the originator of the pear, but only the cultivator of the tree. He desired to retain the original name—Quinn Knight's Seedling.

Mr. N. C. Meeker said he was decidedly in favor of short names for pears. A great many people dare not sometimes pronounce the long names for pears, because they are so hard.

It was then voted that the pear be called the "Quinn" pear.

Mr. Solon Robinson said he thought it the best winter pear that has ever been exhibited at this club. A few specimens were distributed, which were really delicious.

Blackberries.

Mr. S. R. Richardson, Newfane, Niagara county, N. Y.: "Do Dorchester blackberry plants winter kill as badly as the Lawton?"

Mr. Solon Robinson.—No. They originated at Dorchester, Mass., near Boston, where they are perfectly hardy, and where Lawtons are not. As far north as Niagara county they should be protected by covering with straw or cornstalks.

Dr. Peck.—The Dorchester is entirely hardy with me at Croton, is not so productive as Lawton, but far superior.

Mr. N. C. Meeker thinks the Lawton the poorest sort grown. There are wild sorts far superior. Some of the best of them ought to be cultivated.

Mr. Solon Robinson, said some of the best of them had been—that is, the Lawton and Kittatinny.

Dr. Sylvester thought nothing could excel the Lawton in excellence when perfectly ripe.

Dr. Hexamer said that when perfectly ripe it cannot be sent to market, and that is the difficulty with all wild sorts I have ever

seen. In that respect they are more troublesome than the cultivated sorts.

Dr. Peck thought the wild sorts when cultivated had greater firmness than when growing wild.

Mr. Quinn thought those who were not satisfied with the Lawton would find in the Kittatinny, Wilson and Dorchester all that any one could reasonably require.

Horses—Shoeing.

Jas. E. Larimer, Guilford, Ind.: Will any one who knows talk about horse-shoeing, and less about moonshine and water-witching? Farmers are much interested in the subject of horse-shoeing. Much is lost by thoughtless, ignorant or penurious farmers, who either keep shoes on too long, or leave them off until they lose thrice the value of shoes by lame feet. Much is also lost through shoeing by ignorant smiths. The subject needs a thorough discussion."

Mr. N. C. Meeker—I fully agree with this correspondent about the question of horse-shoeing being an important one for farmers. I have had some costly experience in this matter in Southern Illinois. In one instance, we kept an account of the distance traveled in the effort to get a horse shod, which summed up eighty-five miles. That was not all, for the horse was severely lamed during this travel. My boys then concluded that it would be profitable for farmers to have a blacksmith's shop of their own. Accordingly we purchased tools, and they have since done their own work, a little slow and clumsy at first, but better than traveling eighty-five miles to get a horse shod.

Dr. Snodgrass said his father had such a shop and it paid better than any other investment on the farm.

Adjourned.

January 2, 1867.

Mr. Nathan C. Ely in the chair; Mr. John W. Chambers, Secretary.

Machine for Unloading Hay.

Mr. Homer W. Fitch, Lithgow, N. Y., calls the attention of the club to Hinman's automatic hay elevator and conveyor, to be placed in barns, which is a great labor-saving contrivance, for mowing away hay. It consists of two tracks, or ways, a few inches apart, made of scantling and secured to the rafters, near the peak of the

barn. On this railway a small car is fitted to run easily from one end of the barn to the other. The rope to which the horse-fork is attached is fastened to one end of the car, then passes to the further side of the mow over another pulley, and back again to the car. If the mow be three hundred feet long, the horse-fork will carry the hay back as fast as a man can walk, and drop it at any desired place between the front and the back side of the mow. Many of our large farmers are putting up this contrivance in their hay-barns, as they find it saves the labor of several men in mowing the hay away in a long barn. He wished to send it to the club for trial.

The Chairman remarked that there were no conveniences here for such a trial, and it was suggested that in suitable weather a committee might be appointed to visit Mr. Fitch's place.

Mr. S. Edwards Todd said he was acquainted with the machine, and it needed no recommendation, for it is all that is claimed.

Wood-Sawing Machine.

Mr. Jas. W. Havens, 1 Chambers street, exhibited a model of Daniels' wood-sawing machines, to show farmers who are accustomed to prepare their fuel with a buck-saw, how they may save their strength, by being able to saw two or three cords of wood with the same labor that is now required to saw one cord with a buck-saw. The blade of this saw is stretched in the lower end of a pendulum frame, and the edge is made circular; and the frame is so constructed that the weight of saw and frame press the points of the teeth into the wood, and the saw settles downward as fast as the kerf is removed.

The reciprocating motion is given to the saw by means of a cam secured to a journal, which is turned by the hand of the operator. The cam plays in a frame just above the saw. Motion communicated thus by a cam requires less force and much less machinery and space than a pitman and a crank. In this consists the chief superiority of the machine, over others that are worked by means of a crank.

Imitation Fruits.

Mr. Julian Ledion, 629 Broadway, exhibited some beautiful specimens of imitation fruits, consisting of pears, apples, peaches, &c., reproduced entirely true to nature as to shape, color, weight and size, of a material durable, and susceptible of being handled and cleaned when soiled.

Mr. W. S. Carpenter suggested that these things might be turned to great practical utility by having duplicates made of genuine specimens of fruit, with which to compare fruit waiting to be identified.

Mr. P. T. Quinn thought these were the most perfect specimens of imitation fruit that the institute had ever received.

Chinese Yam.

Mr. W. R. Prince, Flushing, L. I., sends to the club some tubers of the Chinese yam for distribution, and gives the mode of cultivation:

Keep the tubers in sand, free from frost, till spring. The blossoms emit a cinnamon odor. By autumn the roots will be slender and a foot long. The ensuing spring cut the roots into sections one and a half inches long, and plant the pieces in rows one and a half feet apart. The vines may be allowed to run on the ground the same as the sweet potato. The roots thus produced will weigh from half a pound to one and a half pounds.

A light soil is preferable, but they will grow on any warm and rich ground. All the sandy soils of New Jersey and the south side of Long Island are suitable for raising the yam. This is the only vegetable to which God and nature have imparted a *pro rata* portion of azote sufficient to sustain the muscular force of man without the use of meat, and at the same time be superior in quality.

Unsound Flour.

Mr. F. C. Treadwell presented a report from the committee which was referred back for further action.

Mr. H. P. Smith, Westfield, Mass., said he had little faith in getting inspectors to remedy the difficulty, for the reason that it is inspected by men who generally can be bought. He spoke of having bought thirty barrels of beef of a trustworthy dealer which proved rotten; it was sent back, his money refunded in part only, and the beef was sold to ship owners.

A gentleman remarked that the only remedy lay in having the grain inspected on the farm. The evil lay in the farmers taking a bad quality of grain to market.

Dr. James Knight said that he had found so many obstacles in the cure of his little patients from the use of unsound flour, that he felt like coming to the club and thanking them for what they were doing to counteract the adulterations and swindles in flour,

and he hoped it would result in a reform. All the hospitals, all sick persons, and all having the charge of children, are deeply interested in this question.

Mr. N. C. Meeker said the difficulty partly lay a great way off. Farmers themselves know all about it. It is almost impossible to get good flour or good wheat in the West from the large merchant mills, not because they do not make good flour, but because they have great inducements to ship it elsewhare, and to turn the farmer off with flour and shorts. If one takes his wheat to a poor little water mill, or where they do a small business and know little about milling, he will be almost certain to get flour of the first quality. The trouble is that Boston and Massachusetts folks are too sharp for New-York folks. They have inspectors who will not pass bad flour; then their buyers go out west, particularly to St. Louis and Cincinnati, and make engagements for first-class white wheat flour—they pay for it, and they get it. So extensive and shrewd are their operations, that the people of the West are about as bad off as the people of this city.

Worms in Horses.

A Young farmer writes from Danbury, Conn., "I have a horse troubled with worms. They are about two inches long. Will you inform me the best remedy for them? I have tried all I can hear of thoroughly; but without efficacy."

Mr. S. Edwards Todd replied that calomel is sometimes given as a vermifuge. But it should never be administered except by an experienced veterinarian; and even then it is a dangerous medicine. Sometimes a dose of physic will remove the long white worms. In some instances, a worm ball is given the horse, consisting of two drachms of emetic tartar, with a scruple of ginger made into a ball with linseed meal and treacle, or molasses, which should be given every morning, half an hour before the horse is fed. Sometimes an injection of a quart of warm linseed oil will be found efficacious. An ounce of aloes dissolved in warm water, used as an injection, is also effectual.

P. T. Quinn said he has fed common brown sugar with excellent effect for worms.

Growing Acorns.

Mr. W. R. Price, Flushing, L. I., having presented to the Club two species of the Quercus Cerris for distribution, writes: "There is no difficulty whatever in making acorns grow." He says: "Put

them in the fall two inches deep, or keep them in sand during Winter, and plant them in the Spring one inch deep. They will grow as readily as Indian corn. After they have come up keep down the weeds and keep the ground clear."

Adjourned.

January 8, 1867.

Mr. Nathan C. Ely in the chair. Mr. John W. Chambers, Sec'y.

Early Futile Attempts to Reap by Machinery.

Mr. S. Edwards Todd.—Most people take it for granted that reapers and mowers are of quite modern invention. But such a conclusion is far from being correct. Others have supposed that some American Yankee first conceived the idea of constructing a machine for cutting grain with horses and oxen. But history informs us that reapers were in most successful operation before Christopher Columbus first discovered the Western Continent; and that the sickle and the scythe, in some of the Oriental countries, had been superseded by reapers that were worked by one or two oxen, in the early part of the Christian era.

The first account of a machine to reap grain appears to be that given by Pliny the elder, who was born, it has been supposed, about the year of our Lord 23—more than 1,800 years ago. This historian says: "There are various methods of reaping grain. In the extensive fields of the low lands of Gaul, vans of a large size, with projecting teeth on the forward edge, are driven on two wheels through the standing corn, (oats and barley are called corn) by an ox, yoked in a reverse position, with the machine forward of the ox. In this manner the ears (or what we call the heads of barley or panicles of oats) are torn off and fall into the van. In some places the stalks are severed in the middle by sickles, and the ears or heads of grain are stripped off between two hatchels."

Palladius, an eastern ecclesiastical writer, gives the following account of reapers. He says: "In the Gallic lowlands, they employ a more expeditious method of reaping, requiring the assistance of a single ox during the whole of harvest time. A cart is constructed which moves on two wheels. A low box of boards is constructed on the wheels, and the boards in front are lower than the rest. Behind this cart, two shafts or thills, are fastened like the poles of a sedan chair. To these an ox is yoked and harnessed

with his head turned toward the cart; and the ears or heads are gathered in the box, and the driver regulates the elevation and depression of the teeth with a lever."

The next account of a reaper is given in proposals submitted in Britain, in 1785, for constructing a reaper. This machine was propelled forward by a horse or ox, clipping the heads of grain, and depositing them in a large box, which was emptied when it was full into a store-room. In the details of this machine—a drive wheel, pulleys, pinions, tooth-wheels, and irom combs or teeth—are spoken of.

In 1799 another reaper is spoken of as being propelled by a horse hitched behind it, which cut and laid the grain in a swath on one side of the reaper. A boy could manage the machine, and with one horse would cut a swath about two feet wide, or rather more than could be reaped in the same time by six men with sickles.

In 1806 Mr. Gladstone produced a reaper for cutting grain, delivering the straw into gavels to be bound. Drive-wheels, pulleys, bands, etc., are alluded to in the details of this reaper.

In 1807 Mr. Plucknett constructed a machine in which a horse *drawed* the machine, instead of *pushing* it forward, according to the usual custom of operating reapers. After this period many inventors entered the field, with reapers of an improved construction; and in 1822 Mr. Mann, under the auspices of the Highland Society of Scotland, brought forward a new reaper, which was worked with one horse, and which would reap ten acres in ten hours.

In 1830 a mowing-machine was produced, and soon after that a combined reaper and mower is spoken of. About that time the celebrated McCormick reaper entered the field, astonishing Americans, as well as the farmers of the Old World. From that time up to the present day reapers and mowers of innumerable forms have come into existence; many of which have ended in a total failure, while many others have proved themselves to be a triumphant success, and are now resting on their own intrinsic merits as the ultimatum of perfectibility.

Pulverizing Tussicks or Bogs.

Mr. Wm. S. Rakestraw, Kennet Square, Chester county, Pa.—I want to compost fifty or one hundred cords of tussick in the open air after being dragged out. Would diluted sulphuric acid sprinkled among them be practicable?

Several members said the cost of sulphuric acid would exceed the value of the farm.

Mr. Wm. S. Carpenter.—I would make layers of brush and bogs, and set them on fire; the ashes make a most valuable fertilizer.

Dr. Peck.—I have used them as a mulch for fruit trees by cutting them up with a sharp, strong spade, and a strong Irishman, into slices.

Dr. Hexamer.—I would compost them with manure. It will take two years and a half to decompose them. They are first-rate to make a wall for ditches or to build a dam, for they lie more solid and hold water better than stone.

Liquid Manure.

Mr. S. B. Scanan, Cortland Co., N. Y., inquires how best to save liquid manure, and whether it is cheaper to haul muck a mile and a half up hill or to build a cistern.

Mr. Wm. S. Carpenter believed it better to haul muck for many reasons, and mostly because the compost derived from it is almost indispensable.

Mr. Thos. Cavanach spoke of a case where a large quantity of muck having been used destroyed a valuable strawberry patch. On a light, loose soil these plants do not run very well, though a soil should not be too hard.

Mr. P. T. Quinn.—It is important that muck should be thrown out of the bed and left some time for the water to run out of it. After that it is to be hauled and composted with one-third of manure.

Many who formerly built cisterns for this purpose now do not like them, hence they use muck, which not only thoroughly absorbs the liquid manure, but prevents heating.

Beet Root Sugar.

Mr. Reuben Grant, Sumner, Fillmore county, Minn., inquires what is the prospect of making beet root sugar in this country. It is attracting great attention.

The Chairman and others spoke of it as most certain to succeed.

Mr. P. T. Quinn.—I was informed to-day that a company has been organized in this city with a capital of $3,000,000 to engage in the business in Illinois.

Mr. N. C. Meeker.—Large works have been erected at Chatsworth, Illinois. They have seen difficulties; how they will suc-

ceed this year has not been stated. There is no doubt but the plan will eventually succeed. National or State aid should be given. France gave it and reaped immense returns.

Report of Committee on Unsound Wheat Flour.

Mr. F. C. Treadwell, chairman of the committee on the unhealthy flour sold in the markets of New York and Brooklyn, read so much of the report as had been prepared for the occasion, and it was approved by a vote of the club.

The committee was then directed to prepare a memorial to the Legislature, setting forth the magnitude of the frauds and impositions now practiced by the flour dealers of New York and Brooklyn, with a view to having more efficient inspectors appointed, who would examine the flour thoroughly and honestly, and not put their brand of approval on a barrel of flour when they knew it to be bad.

The chairman reiterated some of the suggestions made by H. B. Smith, of Westfield, Mass., touching the inspection of beef. Mr. Smith purchased a large number of barrels of beef, which was recommended to him as a choice lot of meat. He ordered it shipped to Westfield, where it was distributed among the laborers. They commenced cooking it, and soon found that it was all damaged "stinking" meat; and when the barrels were opened, the meat was all green, and emitted such an offensive odor when it was being cooked that it could be smelled more than fifty yards from the house. He returned it to New York, where it was all pronounced good beef except two barrels, and was sold to shipmasters for good beef. It was suggested that this will be the way with flour inspectors. The evil cannot be reached without encountering serious difficulties.

Mr. Ferdinand Lawrence said he was opposed to compulsory inspection; he had been prominent in getting the inspection of hops done away with.

Paris Exposition.

Dr. Snodgrass offered the following resolution:

Resolved, That the Farmers' Club of the American Institute observes with great satisfaction that the Congress of the United States have authorized the Commissioners of Agriculture to collect and forward to the Paris Exhibition specimens of all the cereals grown in this country, and that we recommend to the farmers throughout the country to forward at once the desired specimens to Washington. Unanimously adopted.

How to Raise Potatoes.

Mr. J. W. Gray, Albion, Orleans county, N. Y.—"In answer to inquiries, I will tell the club how I produced twenty-eight bushels of 'Early Goodrich' potatoes from one peck of seed. The ground on which they grew raised only a fair crop of wheat the previous year, the stubble turned under soon after harvest. In the spring a pretty heavy crop of barn-yard manure was spread on the surface, after which it was plowed and dragged, and cross-plowed and dragged again. The seed was then cut into single eyes, and planted two pieces in a hill, the hills three and a half feet apart each way. The ground was kept clean and well cultivated, and that is where the great secret of success lies in producing a large crop of potatoes or anything else. I am satisfied I can produce a larger yield the coming year. My yield of 'Gleasons' was nearly as large, and I think they can be made to yield more than the Early Goodrich."

Snakes.

Dr. J. V. C. Smith.—Having traveled extensively in foreign countries, and noticed many wild animals, I propose at some future time to give my views on snakes. Although they are loathsome and shocking, they certainly have a distinct purpose. In South America I saw an anaconda twenty-one feet long, shed his coat, and this he did by turning it inside out, even to the eyes. I have also seen the snake charmers in Egypt, the same class of men spoken of 2,000 years and more ago. These are Arabs, but they belong to a particular family in which their art has been transmitted from father to son; and they are looked upon by the other Arabs with the same wonder that we look on them.

Mr. P. T. Quinn moved to take up the subject of "Spring Crops" at the next meeting. Adjourned.

January 15, 1867.

Mr. Nathan C. Ely in the chair; Mr. John W. Chambers, Secretary.

One Hundred Dollars for the best Raspberry.

Bridgewood, Bergen Co., N. J., *Jan.* 12, 1867.

Farmers' Club, American Institute:

"I will give $100 for the best four quarts of raspberries, for general cultivation, as a market fruit. The only restrictions to be placed upon the award are that the plants shall be hardy and prolific.

The fruit shall be exhibited and the prize paid at the rooms of the American Institute, as the Farmers' Club or a committee shall designate. A. S. FULLER.

Mr. N. C. Meeker—A committee should be appointed before spring, certainly before the fruiting season, to decide on the hardiness of the plants. Perhaps it would be best for the chair to appoint a committee, which shall appoint the awarding committee.

The chair appointed Messrs. W. S. Carpenter, P. T. Quinn, and N. C. Meeker. It is to be hoped that after the award those wishing to plant the fruit will be able to do so wisely.

Flax Shives.

Mr. C. Boorum, jr., Millford Flax Mill, N. J., suggests that farmers may get a benefit from the use of flax shives by hauling them into the barnyard ; they will absorb liquid manure and serve a good purpose. As a flax-breaker and dresser, I have thrown and given away thousands of loads. In some places they are sold for twenty-five cents a load. The same men carried them away year after year, and use them on potatoes grown in stiff clay soil.

Mr. N. C. Meeker.—This suggests flax fiber. I would recommend the club to look into flax culture, which certainly is profitable; so also the spinning and weaving of it, but capitalists in this country seem to overlook it.

In Western Illinois they are beginning to learn the value of the flax crop. Establishments have been erected for working up flax, and this year yielded a profit of from $30 to $40 an acre. In other sections capitalists agree to build works if the farmers will agree to raise the flax. It is no more work to raise flax than oats, and manufacturers can sell every pound or yard. Both parties must get rich. Cotton is not as profitable. Perhaps we shall have some towels that will do to wipe on more than once.

Fence Posts.

Mr. Wm. Barnes, Rives, Jackson county, Michigan.—How shall I prepare fence posts to last longest? The timber is post oak.

Mr. R. J. Pardee.—Common copperas dissolved in an old kettle makes a good solution ; dip in the posts and they will last a long time.

Prof. Tillman.—There are various substances which can be used. Corrosive sublimate is one, sulphate of zinc (white vitrol) is

another; but they are too expensive. Carbonizing, by means of a moveable jet of flame, is the best plan, and is adopted by the French for railroad ties.

Mr. Cavanach.—Coal-tar is cheapest and is used by most of the nurserymen.

Mr. Nichols.—I dipped pine and chestnut posts in tar five years ago, and they are still sound. White cedar posts with us rot in from three to four years.

Mr. Adrian Bergen.—Some posts last five years; again, some last twenty. People do not understand this subject. Posts should be set on end three years to season, then they will last.

Mr. H. B. Smith.—A wet post covered with tar will rot in a short time. The most important point is to have the timber well seasoned.

Mr. John Crane.—Timber is much more durable if cut in the summer.

The Product of Half an Acre.

Mr. H. A. Holderman, North Manchester, Wabash county, Ind., says: "That from this ground he raised ten bushels Irish potatoes, five bushels sweet potatoes, two and a half bushels flour corn, two pecks pop corn, one bushel Lima beans (next year will plant with the eyes down and will get double the crop), five bushels of turnips, two bushels onions, half bushel vegetable oysters, forty-two head of cabbage, eight bushels of tomatoes, fifty bushels of hemp seed, half bushel of snap beans, peas, onion sets, squashes, cucumbers, melons, pumpkins, raspberries, enough for the family, apples for the family, and besides gathered garden herbs. On the ground are thirteen young apple, three cherry, three pear, and seven peach trees, a strawberry bed, and a stable and cow house, 40x20. The ground was worked in spare hours, and the product made the grocer's bill small."

Western Grape Culture.

Dr. C. J. May, Warsaw, Ill., was introduced, and stated some facts touching the culture of grapes. He said his experience with grapes had been principally in Illinois, where they have over 2,000,000 of grape vines. They commenced there with the Catawba. In 1863 and 1864 the first buds were killed. After the Catawba they introduced the Delaware. Then they planted the Concord grape. He thinks that every vine that was lost died in

consequence of too much water in the soil. All varieties suffered about alike in this respect. They prune on Fuller's system, with arms and upright canes. Low training succeeds the best in Illinois. We have no mildew there. We have found that it is absolutely essential to lay down the vines in the winter. Grape vine wood ripens well there. Large quantities of wine are made. The Clinton grape makes fine wine. Vineyards are mostly on the bluffs of the Mississippi. The Isabella does not ripen there.

Water Melons.

Mr. H. B. Whitney, Gardner, Mass.—I wish the club would tell me how to raise water melons, what is the best manure, how far apart, and how many plants to be left in the hill. Can Squankam marl be used as soon as it comes from the pit?

Mr. N. C. Meeker.—Many other farmers want or ought to know more about water melons. They always plant, sometimes they plant all spring and summer; boys always are planting, and they get only little bits of things, many of which they plug before they get ripe, because they cannot tell ripe from green ones.

Mr. W. S. Carpenter.—For ten years I have been successful; before that I used to fail. I dig a hole two and a half feet deep, three feet across, fill to within six inches of the surface with green stable manure, then add good soil so as to make a hill six inches high, and I plant from ten to twelve feet apart.

Dr. Snodgrass.—They like a sandy soil. I once raised fine ones by planting where wheat had been thrashed; some straw was left, they ran among the straw.

Mr. P. T. Quinn.—I would use thoroughly decomposed manure. They grow best on land freshly cleared. There should be three plants to a hill.

Mr. Nichols.—I raised good melons among corn.

Mr. Wm. S. Carpenter.—This might do on sandy land, though few will succeed. The gentleman who inquires lives in Massachusetts, where the soil is hard and cold. The fresh manure will be like a hot-bed, and will keep the vines warm and moist. I would speak here of the Japan musk-melon as the only kind worth growing. The seeds will be found in most seed stores.

Mr. R. J. Pardee said that the terminal buds of the vines must be pinched off, for the purpose of promoting fructification.

A Chestnut and Cedar Grove.

Mr. Wm. M. Field, Smyrna, Chemung Co., N. Y., asks how he can produce to the best advantage, chestnut trees and a cedar grove.

Mr. R. J. Pardee said the chestnuts should be planted before the nuts have become thoroughly dry, and they should be planted where the trees are to grow, as chestnut trees are the most difficult trees to make live after they have been transplanted. The most expeditious and economical way to produce a cedar grove is to obtain small young trees from the open fields, where they have always grown in the sunshine.

Facts from an Illinois Farmer.

Mr. E. W. Brown, Cambridge, Ill.—I wish some one from every State would give an account of their section. I give a sample of mine. Price of improved lands, with common house, and young orchard fenced on the outside, from $30 to $40 an acre. Good prairie farms, from five to ten miles from the railroad station, $10 to $20. Common lumber at the station, $28 a thousand; brick at the kiln, $10 to $12; masons' wages, $4 a day; carpenters', $3; common hands, $1.50; by the month, $25; a good team, $300; lumber wagon, $130; harness, $33; steel plow, $25; harrow, $12; horse-shoeing, $5; coal at the bank, 10 to 12 cents a bushel; wood, delivered, $6; groceries and dry goods, nearly one-fourth dearer than in the East. Cost of raising grain to the renter, where he gives one-third of the corn in the crib, and small grain in the half bushel at the machine; oats, 25 cents, 50 bushels to the acre; wheat, 65 cents, 20 bushels; corn, 16 cents, 50 bushels. A hog will eat 10 ears a day on an average, for the first 18 months of his life—150 ears make a bushel (this is 25½ bushels), and this will make him weigh 350 pounds, but he must have good care. Clover and fruit grow nearly or quite as well as in the East. As a general thing land in and next to groves is poor and rough, as well as on one side of the streams. Cost of breaking up prairie, $3; the two first crops of wheat will average 25 bushels an acre; after that 15. Corn on good land 40, oats 45, rye 20, barley 20, and buckwheat 20. I find it a great advantage to watch the price lists of grain, &c., to talk with the best farmers, and to use my own judgment.

The regular subject was then introduced: "First work in Spring."

Mr. S. Edwards Todd.—The question at this season of the year is, how old fields can be restored and how good fields can be kept good. Not one farmer in five hundred sufficiently values red clover, not only as a forage plant, but as one that has power to unlock hidden stores. Its influence is magical. It acts not only on the surface, but it is a subsoiler. The long tap roots strike deep and change barren earth into fine mould. There is no way to restore old fields except by clover. Without it many old farms would be abandoned. Some farms which produce poor crops, even when new, yield largely after clover. It will grow and mature where other grasses would perish. Much of the despised and uncultivated land of Long Island and South Jersey should be brought into clover.

Dr. Snodgrass.—The hilly, slate lands of Maryland and Virginia have been made very fertile by the use of clover, but it was in connection with plaster, for both were sown together.

Dr. Hallock.—I had a piece of clover, and it was a question whether I should cut it and carry it away or turn it under.

Dr. Snodgrass.—The second crop is to be turned under, after being once fed down. Then sow to wheat, then clover, and plaster again.

Mr. Carpenter.—A neighbor of mine restored a hill top, where it was difficult to haul manure, by sowing clover and turning it under. The great advantage is to bury it green. It feeds deep and does not exhaust the surface.

Mr. Stevens.—Clover grows at a lower temperature than any other grass, that is forty degrees, and has a month more to grow. None other grows on such crude material, and requires less vegetable mold. It produces thirty or forty tons of roots, which might seem to be the main value of the crop, for not only do they enrich but they make the soil porous. Cattle feeding on it impart more fertility than they take away.

Mr. R. J. Pardee said in central New York he had known farmers to purchase a farm at thirty dollars per acre, and pay for their entire farms in the production of seed for supplying the markets. He said the manner of determining which kind of seed would produce the large kind, was by asking the farmers when they mowed the first crop. He said the big clover must never be cut, if a crop of seed would be raised. The first crop of the small kind, must be mowed the last of June or the fore part of July.

Mr. Wm. S. Carpenter suggested that whatever is done with

red clover, the first year's growth is the best and heaviest for purposes of fertilizing the soil.

Dr. Snodgrass said he had heard it stated that guano was of no value as a fertilizer. In Virginia they were employing guano to make red clover grow. A dressing of guano gives the young clover a good start.

Mr. John Crane.—It is important to sow clover and timothy together if hay is the object. Timothy requires clover to shade the ground. It is often difficult to get a good stand of timothy without. In two years the clover will die, the timothy will feed on the old clover roots.

Mr. H. B. Smith said three years ago he raised a crop of heavy clover, and removed it. This he thought was a great error. He should have plowed it under, in order to have received the greatest amount of benefit as a fertilizer.

Dr. Hexamer said the great advantage of the clover crop is, it will benefit the ground. The leaves take more fertilizing matter from the air than most other plants. Therefore a crop of clover will accumulate more material than there was in a field before a crop of clover was produced.

Salting Hams.

Mr. T. D. Balderston, Lahaska, Bucks county, Penn.—I do not put the hams in pickle, but rub them with a preparation, as follows: Four pounds fine salt, two ounces pulverized saltpetre, four ounces brown sugar. Rub the meat well all over, particularly about the bones, then lay on a shelf. In five days, if any of the mixture is left, rub again. In sixteen days they are ready for the smoke house.

Cure for Caked Bag in Cows.

Mr. Balderston also furnishes the following cure for caked bag in cows: Take lime water, about the consistence of thick whitewash, put it in an earthen plate, and about the same quantity of flaxseed oil, beat them well together with a case knife till they are thoroughly mixed, anoint the bag two or three times a day, rubbing it well in. I have used it for many years. Last summer a neighbor had a young sow with pigs; her bag was so hard he thought she would die. I prepared him some of the mixture, and in a few days she suckled and raised her pigs, they having fed them with a spoon while the mother was sick.

Raising Hogs Profitable.

Mr. S. N. Thompson, Southborough, Mass.—Having bought a farm, I wanted to make it fertile. I bought twenty hogs. I kept an exact account with them, and at the close of the year I found they had gained $75, and I had a large pile of valuable manure. Unfortunately they were lank and long and of the subsoil variety. Had the breed been better I should have made one hundred per cent more. The Chester Whites, though easily fattened, are too coarse, and if mixed with all other kinds, too much given to hard work. I am investing my money now in the Yorkshires; they are of large size, thin skin, small bone, and fine grained meat; also in the Essex; they are of medium size, they mature early, are quiet and easily kept. If corn is not more than $1 a bushel, and pork not less than eight cents a pound, I consider the business the most profitable I can engage in, for I expect by so doing to make each acre of my farm to keep a cow.

Regarding scraps, I find pork scraps worth $1\frac{3}{4}$ lbs. of corn meal, and beef scraps 20 per cent. less.

Adjourned.

January 22, 1867.

Mr. Nathan C. Ely in the chair; Mr. John W. Chambers, Sec'y.

Report of Unsound Flour.

The subject of unsound flour was again brought up, when the chairman stated that the subject should be disposed of. He thought it is a subject which might be discussed for six weeks, and we be no wiser for it.

Mr. S. Robinson moved, and it was voted to take the report from the table.

It was then voted that the committee be authorized to memorialize the Legislature touching the subject of unsound flour in our populous cities. The following is the report:

"In their report of last week, the committee confined themselves to a brief statement of the Constitution and laws of the State of New York relating to the inspection of flour, and the appointment of inspectors of flour, meats, etc. They now report a statement of facts in relation to the manufacture and sale of unsound, sour and musty bad flour. Several of the older dealers and consumers recollect very well the high character of New York superfine flour under the inspectorship of John Brown, and the

perfect confidence with which flour, bearing his brand as inspector, was sold and re-sold throughout the mercantile community. No one buying a barrel of flour of any grade bearing Brown's mark, except it were branded bad, had any fear of getting unsound flour. Now the case is reversed, and almost every purchaser fears being cheated with unsound, unwholesome flour. Under succeeding inspectors the standard of Brown was permitted to decline, and millers became insolent and defiant if their flour was not passed above its merited grade. In one instance, Troy millers threatened an inspector with loss of his office unless he passed a lot of inferior flour as superfine. The inspector replied that he would sooner lose his office than break his oath, and the miller sent his flour back to Troy and had it inspected and passed as superfine there, and returned to New York and sold under the Troy inspection. The transactions at the Corn Exchange in putting off unsound flour, through brokers and dealers, are fraudulent beyond description. Bad, very bad flour is passed off as superfine. No lower grade is generally known. In a single case where a sample of middlings or ship stuff was sent in for sale it was remarked by millers and dealers that the miller who ground it did not know his business; that superfine flour could be made of it. Much of the flour branded superfine is made of refuse stuff, sometimes mingled with damaged, even caked wheat, beaten apart by shovels, and turned in with other and less damaged wheat, and sent to the mills to be ground altogether. Millers at the south reserve the best flour of their grinding, mark it family, and sell it at home. The next run or quality they mark or brand extra, and send it to New York. Shippers who buy flour for export put on what mark or brand they please. In one instance, a shipper requested a dealer to put on a favorite mark of another shipper, which the dealer declined doing. One member says the manœuvering and cheating at the Corn Exchange are so common and so bad that he seldom goes there; that they are scandalous, infamous. In one instance, a lot of flour was sold by a factor, who was authorized to sell a larger parcel by the first as a sample. The larger lot was delivered, and found to be inferior to the sample by at least $1 a barrel, and returned to the factor, who sold it again as best he could. Such cases are not rare, but common—very common. No reliance is or can be placed in the integrity of any brand. One lot may be of fair quality, and the next vile stuff. You must buy by sample, and hold the seller strictly to it, or

examine every barrel of flour yourself, and test it by mixing and baking, or you are very likely—almost sure—to be cheated. One gentleman wanted to buy a large parcel of good flour and applied to a dealer in wheat to tell of a miller who could supply him. The wheat dealer named a miller who, he said, had lately bought a parcel of 'prime wheat.' On application to that miller, the latter stated that the 'prime wheat' proved unsound; that the flour made from it was still on hand, and must be kept until he could find a customer for it. The parties were too well acquainted not to know that unsound flour, if sold as sound, would be returned. A practical miller stated that in grinding a lot of wheat, which he supposed was turned in as sound, he found it bad, and that the flour was kept on hand a while and then sold to a baker. Of such flour was much of the bread made which was furnished for the soldiers and sailors during the late rebellion. Another old flour merchant, who well knew John Brown and the higt character of his inspectorship, insists that just such another man, if he can be found, should be appointed inspector of flour in New York, with full power to raise the standard as Brown did, and correct the rascally, infamous proceedings of the millers and dealers in unsound flour. The transactions at the Corn Exchange are as bad and as fraudulent as those at the Stock Exchange in Wall street, or even as the 'ring' at the City Hall. That no remedy short of a rigid law, strictly enforced by a firm, intelligent and truthful inspector, can reach and correct the villainy of the Stock Exchange, and the manufacturers and dealers in bad flour. That bad flour must be branded bad, and go, if it goes at all, under that brand and character. The committee are prepared to name witnesses to prove this statement of facts before the board of health, a committee of the Legislature of New York, a committee of the Congress of the United States, or any other body of men empowered to investigate the subject. The Constitution of the United States, in its restrictions upon the powers of the several States, has the following provision:

"No State shall, without the consent of the Congress, lay any imposts or duties on imports or exports, except what may be absolutely necessary for executing its inspection laws; and the net product of all duties and imposts, laid by any State on imports or exports, shall be for the use of the treasury of the United States; and such laws shall be subject to the revision and the control of the Congress."—Art. 1, sec. 10.

Thus it appears that the Constitution, in recognizing to this very limited extent the inspection laws of the several States, reserves to Congress the power to modify and control them. If the several States have no inspection laws, or enact laws clashing with each other, or laws incompatible with the general interests of commerce, the Congress may come to the conclusion that, under the power to regulate commerce, it may provide a uniform system of inspection laws.

The following resolutions were presented:

Resolved, That a memorial be addressed to the Governor and Senate of New York, requesting the appointment of an inspector of flour for the Metropolitan district, in which the city and county of New York are situated, with power to enforce the laws now in existence in regard to the inspection of flour and meal.

Resolved, That a memorial be addressed to the Legislature of the State of New York, requesting that body to pass a declaratory act in reference to the laws now applicable to the inspection of flour and meal; or to revise and modify those laws in such manner as will afford all possible protection to the public health of the community against the deleterious effects of the use of unsound, bad flour, and of bread made of such poisonous materials.

F. C. TREADWELL, Sr., *Chairman.*

New York, *January* 22, 1867.

Spring Wheat.

Mr. George Z. Mitchell, New Jersey.—"Will the celebrated spring wheat of the west do well in this State?"

Mr. John Crane.—This wheat does well with me in New Jersey, but the Canada Club and all other bald varieties are uncertain. It is important to change the seed. It would be a good plan to get seed from the west.

Mr. Wm. S. Carpenter.—I prefer to raise winter wheat. Spring wheat in this section, makes black and poor bread. The Mediterranean is the best variety, and it has improved of late years. One year I raised eighteen acres, and it yielded about thirty bushels to the acre.

Mr. Solon Robinson.—I have always succeeded with White wheat.

Mr. N. C. Meeker.—There are some varieties of spring wheat which make as good bread as most winter wheat, the Rhode Island for instance. It is important to know that spring wheat must be

sowed early, say in February, if possible, no matter if the field is even muddy, for the reason that it requires to be frozen and thawed out, like any winter grain; but its roots are not sufficiently strong to stand the changes of a whole winter.

New Brunswick Oats.

Mr. E. J. Evans, York, Pa., presented a sample of this kind of oats, which yield forty-five bushels to the acre.

Mr. Wm. S. Carpenter.—I recognize this as the potato oats. They are nothing new. By good cultivation oats may be made to yield from eighty to one hundred bushels an acre.

Fruit Preserving House.

Mr. Wm. S. Carpenter showed a fine collection of pears, most of the fall varieties, from the preserving house of Mr. Convoy, Boston. Among this fruit was the Onondaga. They are all in a fresh state, perfectly sound, and looked as if just picked. Mr. Carpenter stated that the house is about twenty feet square, divided into four apartments for keeping various perishable articles separated from each other, and cost about $1,000. It was built under the patent of Professor Nyce, to whom the public owe thanks for his efforts.

Mr. R. J. Pardee.—I had the privilege of tasting some fine strawberries, in Buffalo, two months after they came from the vines. The house in that city is on an extensive scale, and cost $100,000. They are enabled now to keep some articles which persons failed to keep at first. In particular do they preserve fresh meat.

Mr. Solon Robinson.—The plan of curing meat by covering it with parafine seems to me very successful. It is preserved a long time.

Whitney's Hop Trellis.

Mr. Whitney exhibited a model of a minature hop yard, for the purpose of showing how hops, grapes, beans or tomatoes may be made to grow in a horizontal direction, after the vines have attained the desired height above the ground. Posts are first set in the ground, at certain distances apart, and six to ten feet long. Strong wires extend from the top of one post to another over the entire field. A horizontal trellis work is then spread out on these wires, which is constructed of cords and wire. By this arrangement the vines are all spread out evenly in a horizontal plane, thus securing perfect ventilation, and necessary light and heat to develop and

mature the fruit. The cords on which the vines climb are secured to a clamp on the ground near the root of the vine, passed up through loops in the wire overhead, which keeps every cord in its proper place; then the other ends are brought again in the ground, where they are secured to a clamp. It is claimed that vines of any kind will be far more productive on such trellises, than when allowed to twine round poles.

Safford's Swinging Cattle Stanchion.

Mr. Larkin S. Safford, Newtonville, Mass., exhibited a model of an improved stanchion for fastening cattle to their mangers. It is simply the old fashioned stanchion on hinges. Each stanchion is capable of being turned half way round like a gate. All that is claimed for this improvement is, that cattle have much more liberty while their necks are secured in the fastenings than they do when confined in the rigid stanchion. Mr. Larkin stated that when dairy cows are confined in this kind of stanchion it is more convenient to milk them, and the cows keep themselves more clean when they lie down, than they do in the rigid fastenings.

Irrigating Meadows.

Mr. Safford spoke of his plan of irrigating meadows at his place, Hope, Maine. He has forty acres which he irrigates from a small stream, to June, and after haying, till cold weather. He does not allow the water to go on in the winter, as it kills the roots of the grass. Of two fields side by side, one, without irrigation, yielded 400 pounds to the acre, the other, irrigated, from two to three tons. He uses no manure.

Barrels Without Staves.

Mr. D. M. Easton of this city, showed several specimens of barrels or casks made of ten or fifteen thicknesses of veneering, or scales cut from spruce. These run spirally across each other at right angles, and are fastened together with glue. The hoops are on the inside; the heads slip down upon a hoop with which it forms half of a dove-tail joint, and is secured by cement; the head and the shell of the barrel previously having been turned in a lathe. These scales are cut by a machine which costs less than $1,000; it will cut from 60,000 to 70,000 a day; thirty of them are cut from an inch board, and any kind of timber will answer—pine, beech, spruce, &c. The cost is one-third less than a common barrel, and

they can be made rapidly. These barrels have straight sides. It is claimed that they will hold petroleum and alcohol better than iron, and that they can be used for any purpose required of any other vessel.

Mr. Wm. S. Carpenter.—The members of the club have been so much attracted by this invention, that no time is left for discussing the subject appointed for the first week in spring. I hope it will be laid over for the next meeting.

Winter Gardening.

Mr. C. Taber Brooklyn, L, I.—It is a mistake that all garden operations should be left until Spring. Several things can just as well be done now as then, some better. Manure may be spread around the fruit trees and shrubbery, among currant, goosberry, raspberry, and blackberry bushes, over asparagus, rhubarb, and strawberry beds, as well as on the grass plots or lawn, using very fine for the latter. The manure will be advantageous as a mulch, while the Winter rains will carry the soluble portions into the soil, ready to be taken up by the rootlets in Spring. Stakes will be needed next Summer for raspberries and blackberries, trellises for grapes, poles for dahlias, &c., and these can be prepared, in part, at least, now. Grape vines, currant, goosberry, roses, honey-suckles, and other shrubbery, may now be pruned, and cuttings made for increasing the stock, burying them in the cellar, until Spring. A hot bed will be wanted in February or March, and the sashes and frame should be in readiness. The seed box should be overhauled, and a memorandum made of the needed additions. It is always best to purchase seeds early, while there is a good stock to select from. Look over the vegetables in the cellar, and select some of the best for seed. Home grown seeds should always take the precedence over those obtained from the stores. Decide upon the tools wanted, and procure them before the best have been selected.

Lice on Cattle.

Ed. Payne, Turin, Lewis Co., N. Y. I make a large wood pipe with a stem of elder; put a live coal in the bottom, fill with cheap plug tobacco; then blow, but not draw, the smoke over every part of the animal ; meanwhile have a blanket to keep the smoke confined in the hair this should be repeated once a week, three times.

Abortion of Cows.

Mr. J. W. Sturges, New-Berlin, Chenango county, N. Y.—I have a diary of about 20 cows, and four of them have given premature births, the three last about ten days apart. There have been several other cases in this vicinity. Feed has been hay, with barley oat straw, and a few stalks. Stables are five feet, with a four-inch drop, the same in use for several years. The dairymen around can give me no remedy.

Mr. Solon Robinson says.—On approach of the symptoms remove the cow to a comfortable place, apart from others. Half a drachm of opium and half an ounce of sweet spirits of nitre will allay pain in the parts. Unless she is feeble, feed low. When abortion takes place, the fœtus should be buried thoroughly out of the way of the other cows, as the smell is a strong stimulus. A dose of physic and ergot of rye will remove dead matter. Wash with warm water.

As regards this being a contagious disorder, and past remedy, there are great doubts. It would be well in the above case to consider whatever there is not foul stuff in the straw, barley, and even in the hay, more likely in the barley. Perhaps an entire change of food, and even of stables would be a remedy. This is an important subject, and opinions differ.

Adjourned.

January 29, 1867.

Mr. Nathan C. Ely in the chair; John W. Chambers, Secretary.

Mice in Orchards.

Mr. Seth Fenner, East Hamburg, Erie county, N. Y.: I have an apple orchard of twenty acres, set six years ago, which has suffered severely by mice this winter. In the fall I placed a mound of earth around each tree a foot high. Altogether, we have had snow full eight feet deep, and now, on a level, it is three feet. The mice came above the mound, and have girdled my trees five inches in diameter. I tried stamping down the snow, but it did no good, and finally I have had to clear away the snow and bank up the trees, which, in some cases I have done three feet high. On most of the trees the inner bark is unscathed. The loss to young orchards in parts of this county will be very great. Now I wish to inquire of the Club if there is no wash that cheaply and readily can be applied.

Mr. Solon Robinson.—I would feed the mice on plenty of grain, and add arsenic.

Mr. Thos. Cavanach.—Half of 1,600 shade trees in Brooklyn were boxed, and the other half were thickly coated with coal tar. This was about a year ago, and they have grown well.

Mr. P. T. Quinn.—To save the trees I would wind with a hay rope; in addition, this will catch insects and their eggs. In this way I have saved forest trees which seemed past remedy.

Mr. Solon Robinson.—One of the best remedies is soft cow manure wrapped around with a rag.

Mr. R. J. Dodge.—Some time ago I had trees injured by mice, and I inserted grafts above and below, and saved them.

Mr. Nichols, Hammondton, N. J.—I have used coal tar to keep the grub out of peach trees. It was a success, and the trees were not injured. Apply it before the sap rises. The best way might be to tie tarred paper around the trees.

The Chairman.—It will not do for this club to recommend coal tar for trees. It will be best for Mr. Cavanach to watch these trees in Brooklyn and after a time report.

Mr. Wm. S. Carpenter.—If the inner bark is left the trees will live; if not they will die. But in the latter part of June all the bark may be taken off and the tree will live.

Mr. Solon Robinson.—One great reason why mice are so troublesome is because they have no enemies to look after them. I am the friend of skunks and snakes.

Dr. Snodgrass.—We are in hopes soon of having Dr. Smith's treatise on snakes, which he promised us.

A New Hay Fork.

Mr. A. Buckman, the inventor, showed a hay fork composed of a pair of forks, of three tines each, which locks, takes up the hay and trips in an ingenious manner.

Mr. P. T. Quinn suggested to have a committee to see a working model in operation at pitching hay at some future meeting.

Dr. Peck said that farmers are now selecting their implements for the coming season, and the club ought to test new implements for the benefit of farmers in the country.

Mr. Wm. S. Carpenter suggested that there be a trial of the different kinds of forks now in use, for the purpose of determining which is the best fork for farmers to purchase.

A committee was then appointed by the chair, consisting of

P. T. Quinn, Wm. S. Carpenter, Wm. Field, N. C. Meeker, J. G. Bergen and S. Edwards Todd.

Brown's Stove Damper.

Mr. G. S. Adams showed Brown's Patent Double Cone Damper for wood or coal stoves, or for furnaces. It is claimed to increase heat, to save fuel, to prevent coal gas from coming into a room, and to make the oven of a cook stove bake bread equally on both sides. Messrs. Carpenter and Chambers spoke highly of it, and Mr. Todd related the wonders it worked in a worthless cooking range.

A Mop Wringer.

Mr. James F. White, Brattleboro', Vt.—This is fastened to the pail and covers it. In mopping the lady can use boiling hot water, and by a device similar to a clothes wringer she wrings the mop dry with the pressure of her foot.

A Bag Holder.

Mr. J. V. Henry Nott, Albany, exhibited his bag holder. This, at first appearance, resembles common platform scales, with a square brass frame depending from the end of the bar, which frame is for holding the bag open. The trucks carry the grain away. It is simple, cheap, and must be useful.

Sash Stopper and Lock.

Mr. Wm. S. Van Hoesen, Saugerties, N. Y., exhibited a sash, stopper and lock.—This can be applied to all windows, and acts precisely as cords and weights, except in letting down. It consists of a simple bolt going through the side of the sash, and regulated by a piece of rubber, which holds the sash in place. It can be attached in a few minutes, and costs ten cents.

Mr. Solon Robinson.—It is one of those simple things which makes one wonder why he could not have seen it himself.

Substitute for Tile in Draining.

Mr. James Laurie, Chalmers, White county, Indiana, gives an interesting and clear account of his method of using poles for draining instead of tile. First he rives or splits them through the middle, then starts the heart with a gouge, and takes it completely out with a tool made like a bent drawing knife. Two halves are then nailed together with sixpenny nails, when with a tool made like a huge pencil-sharpener the ends are worked off so as to fit each other. Joints need not be tight.

Soiling Cattle.

Mr. E. W. Stewart, North Evans, New York: I got my idea of soiling cattle from prominent members of the Club. From ten years' experience, I can most emphatically say that soiling will pay, with or without peat or muck, and especially where manure is scarce. As this process will double the manure, and only one-sixth of the land is required, it is easier to manure one acre than six. From a strong clay soil, in poor condition, one cutting of clover, from forty rods, kept twelve cows fifteen days. Such a crop can be grown on almost any farm near the barn, with a preparation of a year or so. Can we not afford to put an acre in fine condition, that we may get the use of five gratis? Soiling also will enable the feeder to command his stock better than in the pasture; it will enable him to double his stock, and almost double his manure. I kept a strict account of the labor bestowed on thirty-five cows and steers one entire season, and found it only $65. The expense is paid four times over in the extra product—saying nothing about keeping up fences. No man can afford to pasture land worth more than $25 an acre. Because few have adopted it, is no reason; if it were, it is reason for poor tillage, poor sheep, poor cattle and horses. Because few have a good grindstone, is no reason why I should not have a good one.

How much Wheat is required for a barrel of Flour.

Mr. David Dale, Apple Creek, Illinois: I am glad the Club has taken up the question of unsound flour; but there is another one of importance, which is, how much wheat does it take to make a barrel of flour? At our steam-mills we get only 33⅓ pounds, and half a bushel of bran, for a bushel of wheat; that is, we give six bushels for 200 pounds of flour. For years I have thought there was something wrong here. I hope the subject may be discussed, so as to do us some good. When I lived in Ohio, I used to get flour from my own wheat, and generally got forty pounds of flour, and the bran, and ship stuffs. If the wheat was very good, I have got forty-two pounds of flour, the toll being taken out. Here, at the steam-mills, we get flour in exchange, and often very poor flour, for good wheat. It looks as though we were swindled out of six and two-thirds pounds of flour on every bushel of wheat. Still we do not know, but we do know that the millers are getting rich.

Mr. N. C. Meeker.—The true remedy for farmers is to have mills and grind their own grain. A family of seven persons will consume ten barrels of flour in a year. The cost of going to mill and the toll, at present prices, is fully one-half, or $75 a year; hence, a mill will more than half pay for itself the first year. But should it do no more than a quarter, it will be a good investment. There is not the least doubt but the quality of flour will be superior to that generally in use.

Early Potatoes.

Mr. C. Taber, Brooklyn, L. I.: To get new potatoes a fortnight in advance of those planted in the open ground, however early, take shallow boxes of any convenient size—starch or soap boxes may be sawed so as to make two, four to six inches deep. Spread an inch of fine manure on the bottom, then an inch of dirt, on which the single eyes or small pieces of potatoes are laid, eyes upward, about two inches apart over the surface, and cover with two inches of soil. Prepare these boxes from the first to the middle of March, keep them in a moderately cool place for a week, then place in a warm room, watering as needful, and giving as much sunshine and air as possible, avoiding frosts. They may be set out of doors every pleasant day, and by the time the weather is suitable for planting they will have strong stalks several inches high. To transplant, remove the bottom, raise the sides, and cut through the mass, taking out two inch squares with the potato and principal roots, and when set out there is scarcely a check to their growth.

To Fix Pencil Writing.

Mr. C. Taber: "For this discovery I am indebted to the Rev. L. L. Langstroth of bee notoriety. His well-filled memorandum book containing pencilings of years, attested its durability. It is simply to breathe upon or otherwise moisten the page as soon as written, and when dry the lines can scarcely be erased. Let any one write both ways on the same paper and note the difference. Passing the moistened tongue over the writing more effectually fixes it, making it nearly as durable as ink."

The regular subject "Farm Work in Spring," was then taken up.

Mr. W. S. Carpenter read the following interesting article touching the subject of the commencement of farming operations in the spring of the year:

No farm is complete without a garden of sufficient size to grow a variety of vegetables and small fruits for the use of the family, and when properly managed, it will furnish a large supply for the table throughout the season. In order to get the full benefit of our favorite vegetables, a succession of plantings must be made. When the first crop of peas is well up a second planting should be made. This may be repeated several times with success. Early, medium and late beets should be planted at different times to furnish a succession for the table. Sweet corn is not only a luxury, but it is nutritious and healthful. It should be planted every two weeks from the first of May to the first of July, which will furnish a supply of green corn from July to November.

Hot-beds.

Every farmer should early in March make a hot-bed, which is indispensable to the wants of his family. Early plants, tomatoes and other kinds of vegetables, may be brought forward in the hot-bed several weeks in advance of those started in the open border. I prepare a hot-house in the following manner: The earth is excavated to the depth of two and a half feet, four feet wide and six feet long, which will be large enough to furnish a good stock of plants for the use of an ordinary sized family. Place around the top of the excavation a board frame six inches high on one side and fifteen inches on the other. Set the frame so that the slope will incline to the south. When this is done, fill the pit within six inches of the top of the ground with unfermented horse manure, leaves from the woods, or spent hops from the brewery, which must be well trodden down. Then put on the top about six inches of finely-pulverized soil, rake down smoothly, put on the sashes, and your hot-bed is completed. Some plant the seeds immediately—others prefer to wait until heat has been generated, which usually takes place in the course of two or three days. My practice has been for several years to plant the same day, with the following varieties of seeds: one row four feet long, running north and south, with two or three varieties of tomatoes, sticking a small stake, with the name written on it, at the head of each variety; allow ten inches space, and make another row for early cabbage and lettuce—a variety of lettuce called Ice Drumhead is one of the best, which should be transplanted to the open border. In the third row I plant peppers and egg-plant—large Bull-nose is the

best pepper; improved New York Purple the best egg-plant. Another row is planted with celery.

The balance of the bed I sow in rows with early lettuce. I prefer for this purpose a variety called Early Curled Silesia; it is the earliest and best. I then sow evenly over the whole bed the Early Scarlet turnip radish, which will be the first to come up, and ready for use on the table, without interfering with the growth of the other plants. The lettuce, when ready for use, should be cut off, leaving a crown to each plant, which will soon furnish another growth, and may again be cut as before. I have made six cuttings from the same plants, each successive growth more delicate than the other. To produce this result, the sash should remain on most of the time, to be removed only on a warm day.

Early Peas.

The first crop to be planted in the garden is the pea, for early use, which should be done as soon as the frost is out of the ground. One of the best varieties for the first crop is Daniel O'Rourke. A board placed edgewise on the north side of the row will hasten their maturity. As soon as the ground can be well pulverized, beets for early use should be planted, also onion seed and sets. If the ground should again freeze it will not injure either of these vegetables. I would recommend the early Bassano beet for the first crop. If the spring be favorable, all these may be planted before the end of March. Much should be done in this month in the garden and orchard. The manure that covered the asparagus bed should be forked in, and after giving it a good sprinkling of salt should be raked level, which, if the roots have been properly planted, will be all that is necessary to insure a good crop.

Saving Cions.

Cions should be cut early in March, and buried two-thirds their length in a shady place. Grafting may be done with the apple and pear any time from the last of March to the full expansion of the blossoms of those trees. The cherry should be grafted before the first of April, and the plum by the fifteenth. An excellent grafting wax is made of six pounds of resin, one pound of tallow, and one pound beeswax. This melted together and made into rolls is ready for use at any time.

Care of Fruit Trees.

The orchard should be attended to, cutting out all suckers of last year's growth; scrape from their trunks all loose bark, under which lie myriads of insects and their larvæ, that are destructive to the orchard.

I am decidedly opposed to cutting off large limbs, except such as are decayed. I have seen whole orchards ruined by trusting to an inexperienced hand to cut, without judgment, a third of the limbs from an old tree which had been neglected when young. It is a fatal mistake to attempt to make a model of such a tree. Let all the large limbs remain; only remove those that are decayed, and the small ones that may prevent the sun from entering through its branches.

Care of Stock.

Before the 1st of March every farmer should have fed his stock with all the coarse fodder; but if he has not done so, let me advise him not to give it to his cows that are to make his dairy the coming season, nor to his oxen, if he expects them to do good service on the farm. All of his animals should have the best hay and other feed reserved for their use, from the first of March to the time for grazing.

Future Plans.

Good judgment and skill are brought into requisition on the farm in early spring. Much of the work through the winter has been head-work, which, if clear, effects much in the end to his advantage. He has decided about how much corn he will plant, and he knows that an old pasture lot or meadow, that fails to yield more than a ton to the acre, is the piece to select. He is quite sure of getting better results from such ground in his crop of corn than from ground already under the plow.

After two years' cultivation, when in grass, he will find that this pasture lot and meadow will increase in productiveness three-fold. Experience has taught him to plant his potatoes where his corn grew last year, and if he thinks the oat crop is advantageous he will plant less potatoes and divide the lot with the two crops.

In New York State but few farmers put in any field crop before the first of April, and but little plowing is done; but the blue birds will have come, which will remind him that all that is lovely in nature will soon put forth, and it is the husbandman's duty to

dress and assist the full development of everything that conduces to the comfort of his family. Before the grass starts the meadows should be examined, to remove all obstructions to the mowing machine; he should look well to his fences—particularly those that divide his farm from his neighbors; the latter observance promotes good feelings in a neighborhood, and should not be neglected.

Field Crops.

The first field crops to prepare for are the oats and potatoes; and as these are important crops to many farmers, I will give my experience in producing the best results. Oats are adapted to a cool climate; they may be successfully grown where the thermometer seldom gets above 75 degrees. It is known to all practical farmers that a cool summer is sure to favor a good yield of oats; and in order to get the best results, the seed must be planted as soon as the ground can be well pulverized in the spring. In this latitude the first of April is the best time. If the ground is strong, from three to four bushels should be sown to the acre; and if the land has been well prepared, it is not unusual to get from 50 to 100 bushels to the acre.

Potatoes.

The country is indebted to the late Chauncey Goodrich, of Utica, for his efforts and great success in producing many greatly improved varieties of seedling potatoes. A variety called the Early Goodrich will cause his name to be remembered as a public benefactor.

For many years I have been experimenting with most of the new seedlings as well as the old varieties. I have for several years abandoned the cultivation of the Mercer, Prince Albert, Peach Blow and Dykeman. I have found that many of the newly introduced seedlings are more hardy, more productive, and some of them better in quality.

I will not at this time attempt to describe the quality of these new seedlings, but will at a future meeting give a description of the most meritorious for general cultivation. The following mode of culture I find to produce the best results: I thoroughly plow the ground as soon as I can put it in nice condition, and strike out the rows two and a half feet apart; the seed is cut to two eyes and dropped from twelve to fifteen inches apart, the greatest distance allowed to the strongest growers, and cover with a plow.

In the course of ten days or two weeks the potatoes will have sprouted, but not yet through the ground. I then cut the top of a well-branched tree, the body of which is about ten inches in diameter; with a team I drag this across the rows of potatoes, which at once clears the field of all weeds, and leaves the ground in a level and very fine condition. In about two weeks more, if the potatoes are all up, the plow should be run through and the vines dressed with the hoe. I have now prepared and ready for use five barrels of live wood ashes, with one barrel of plaster, thoroughly mixed, which is applied by putting a small single handful to each hill. The plow should be run through two or three times more, but not after the vines are in full bloom. A fatal mistake is often made, thinking the crop needs no more attention. In about two weeks from the last plowing, the weeds will begin to show above the vines; the potatoes must then be gone over and all the weeds pulled out, and after two weeks more, if the season and soil have favored the growth of weeds, and they appear above the potato vines, they should again be destroyed. One man will weed an acre in a day, if attended to at the right time. A few examples may more fully illustrate the importance of keeping the potato field free from weeds.

More Weeds than Potatoes.

I have three neighbors whose farms join mine. The land of each is about alike for productiveness. Neighbor A planted on a piece of ground that had been highly manured and used for a pickle-patch the year before, a variety of potatoes called Pink Eye Rusty Coat, whole, in hills, three feet apart each way; they were plowed out four times and left in good condition. By the 15th of July the weeds began to show above the vines. The 15th of August no vines could be seen; the weeds had taken possession of the field. At digging time weeds had to be mowed off to find the hills of potatoes. The yield from this field was about ninety bushels of medium-sized potatoes to the acre. Neighbor B planted five acres of the same variety of potatoes; they came up well and looked very promising after they had been plowed out four times. This field was planted in drills with whole potatoes, 15 inches apart in the row, on ground highly manured for corn the year before, and the potatoes received a top-dressing of bone. About the middle of July, the weeds looked promising, and a month later they had

prossession of the field. He was obliged to mow them to dig the potatoes, which yielded not over 150 bushels to the acre.

Clean Cultivation.

Neighbor C planted about three acres of the same variety of potatoes, on ground where corn had been grown the year before. The seed was cut to two eyes, and planted in drills two and a half feet wide and fifteen inches apart in the drills. The potatoes came up well, and were well tilled. About the 1st of July the weeds were pulled out, and again on the last of the month. This piece was the admiration of the neighborhood, nothing but potato vines could be seen. There were no rank weeds to be seen that would have robbed the vines of what they needed to develop the tubers. The yield from this piece was estimated at not less than 260 bushels to the acre, the most of them marketable potatoes. To raise a good crop of potatoes several things are necessary to be observed.

Rotation of Crops.

Never plant twice successively on the same ground. Change your seed every year, and if possible get them from another section of the country, put the ground in good condition, plant in drills two and a half feet apart, and from twelve to fifteen inches in the row. Cut the potatoes to two eyes. After the first plowing give them a topdressing of plaster and ashes. Cultivate well until they are in blossom, then keep all weeds pulled out, and a satisfactory crop will be the result. Work on the farm when rightly directed is full of interest and produces satisfactory results. The farmer is not only a consumer, but he is also a producer, and therefore a benefactor of the human race. The prosperity of this country greatly depends on the development of agriculture. Paralyze this arm and what would be the result? The wheels of the manufacturer would stop, the merchants' doors would be closed, the sail that whitens every avenue of commerce would be furled and prosperity would be at an end, not to be revived until the revival of that power which creates the wealth of the world, viz., agriculture.

Planting Potatoes.

Dr. Hallock, Dr. Hexamer and several others, related some of their experience in planting potatoes, and Dr. Hexamer promised to write out an account of some of his experiments in the management of potatoes, and to read the paper at a future meeting of the

Club. He made numerous interesting experiments last season with large and small tubers, with eyes, with cut and uncut seed, with peelings, and with peeled potatoes.

The conclusion to which all the speakers arrived is that potatoes of a medium size, if fully manured, will yield the most and the best potatoes.

Origin of Potatoes.

Mr. Thomas Cavanagh, of Brooklyn, read the following essay on the origin of the Irish potatoe :

"The botanical name of the potatoe is *solanum tuberosum*, of Linnæus. The potatoe is a perrenial plant, found growing in a wild state in South America. Humboldt thought it was doubtful if it was indigenous there, as tubers of the wild potatoe, planted by the side of the cultivated variety, differed very little from it. Sir Joseph Banks thought it was first brought into Europe from the mountainous parts of South America, in the neighborhood of Quito, where they were called papas. They were introduced into Spain in the early part of the sixteenth century. From Spain they were brought into Italy, where they were called tartufi, from the truffle or underground mushroom. The potatoe was received by Clusius, at Vienna in 1598, from the governor of Mons, in Hainault, who procured the roots from the Pope's Legate, under the name of tartufi; it was then in use in Italy. In Germany it received the name of hartoffel, and soon spread rapidly through that country. The potatoe found its way to England by a different route, being brought from Virginia by Sir Walter Raleigh, who went there in 1584. Thomas Heriot, in a report of the country, describes a plant called openauk, having roots as large as a walnut, in clusters, and says they are a good food, either boiled or roasted. Gerarde in his Herbal, published in 1597, gives an illustration of the potatoe under the name of the Potatoe of Virginia, which name it retained for some time, in order to distinguish it from the *convolvulus batatas*, or sweet potatoe. Sir Jos. Banks says the sweet potatoe was used in England long before the introduction of the American potatoe. They were candied and sold as confectionery. The potatoe was known in Ireland sometime before its introduction into England. Sir Walter having a large estate in that country, it became in course of time an article of general consumption in Ireland, and for many years Ireland was known for its fine potatoes. We suppose it was for this reason they obtained the name of Irish potatoes. Gerarde thought them a great delicacy. The

tubers were roasted and steeped in wine and sugar, or baked with marrow and spices. The Royal society in 1663, took measures for encouraging the cultivation of the potato, with a view of preventing famine; and it seems not a little singular that in our own times, the extensive cultivation of the potatoe in Ireland produced the very evil they desired to remedy. The failure was no doubt owing to the want of fresh stock. Some writers of those early days thought they were only fit food for swine. Another says they make good food for poor people. He left quite a numerous progeny; for there are a good many people just now who think potatoes almost too good for poor folks. Evelyn, who wrote in 1699, says: "Plant them in your poorest ground; take them up in November for winter use, and there will yet remain stock enough in the ground for the next season." This shiftless way of raising potatoes was in practice in Scotland. For many years, the Irish seem to have been the only people who appreciated the true value of this esculent; for nearly three hundred years the potato has been their chief staple. It has been said that a people who use the potato as their chief food soon degenerate. This theory is not well founded, for nowhere can there be found a more hardy race than the Irish. Years of oppression and misrule have done more harm to Ireland than the extensive cultivation of the potato. The tubers of the potato, having no peculiarity of taste, consisting chiefly of starch, approach nearer to the nature of a flour or the farina of grain than any other vegetable root. For this reason it is almost universally liked, and can be used longer than any other vegetable without becoming unpalatable. Among the many uses of the potato in former times was the manufacture of wine and spirits. Still, as wine is made of old boot-legs, and whisky out of printers' rollers, we need not be surprised at potatoes making good wine. Some genius in France has discovered fifty different ways of cooking the potato.

Converting City Garbage into Manure.

Dr. Thompson of Auburn, N, Y., addressed the Club on this subject. He said he had made arrangements with the authorities of this city for disposing of decaying matter. The plan is to furnish a perfectly air-tight safe to every house in which refuse and offensive matter is to be deposited; it will be sprinkled with charcoal and sulphuric acid, or other preparation, according to the kind of manure required, which will deodorize the mass and produce no

injury to any one in the house, and it can be carried out of the city early in the morning without scattering disease; thence it goes to a proper place, where it is fermented and ground with unslacked lime, ready for the farmer's use.

Dr. J. V. C. Smith, spoke of the great want in this city of places of retiring; the condition of things was shameful to the authorities. The city of Paris had set them a proper example.

Adjourned.

February 5, 1867.

Mr. Nathan C. Ely in the chair; Mr. John W. Chambers, Sec'y.

Rats.

Mr. J. C. White, Van Buren, Arkansas, asks what is the best mode of building corn cribs? Half his corn is destroyed by rats after it is placed in the crib. Is there a remedy?

Mr. Solon Robinson.—In Ohio they have anti-rat societies; they go out and hunt rats, and give premiums to those who kill the most.

Mr. W. S. Carpenter.—It is easy to build a corn house rat proof. It should be placed on piles three feet from the ground, on which ten quart pans are inverted. Flat stones, or even boards might answer, then have moveable steps. The floor of a corn crib always should be open enough for ventilation. Much corn moulds for want of this precaution.

Mr. N. C. Meeker.—The question is one of great importance. It is safe to say that rats destroy and consume grain enough to feed a million of people.

Success in Growing Delaware Grape Vines.

Mr. A. Townshend, Oconomowoc, Wisconsin: "I make the Delaware bear in sixteen months from starting the vines or layers. I layer the ripe wood of the last season's growth in boxes made of lath, so open that the roots pass through the sides and bottom. In the fall or spring I remove them to the vineyard, and have fruit the next September. I send a photograph of two Delaware vines, layered May 20; six or eight inches were pinched off August 10. I had a growth of twelve feet in two months and twenty days. I bought vines of Dr. Grant which he called first-class, with joints two and a half inches long, and which cost me here nine dollars each. I have improved their vigor so much that I

have joints from four to nine inches long, and in the first season's growth, and have had them half an inch in diameter."

Mr. N. C. Meeker.—This is very encouraging for grape-growing in Wisconsin. It must be stated that these grapes are growing on the bank of a large lake. If attempted inland no such success could be attained.

Dr. Sylvester.—This method is not new. By using one-year old wood, and being careful to take up all the roots, for seldom scarcely half are removed, I have had vines develop over fifty clusters the next year. Of course, I do not suffer them to remain, as it would nearly destroy the vine to mature the fruit.

Mr. R. J. Dodge.—There is no advantage in having a vine bear early.

Mr. Peck.—My plan has been to cut away all but the upper tier of roots, then cut back the vines to two eyes, and, so to speak, bring the vine to the condition of a single eye plant.

Mr. R. J. Dodge inquired if the second and third tier of roots will grow.

Dr. Sylvester.—This depends on whether the latent eyes are perfect; if they are not the roots will die.

Mr. Thomas Cavanach.—Perhaps as much depends on the depth of planting.

Greeley Prize Grape—"The Concord."

Mr. Solon Robinson—I want to call attention to the award of the Greeley prize. An advertisement in the newspapers alleges that one of the committee gave the reason why he decided in favor of the Concord was, that the taste of the common people is not educated to a high standard; if they see a large black grape, they will gulp it down regardless of quality. Now, as that member of the committee is present, he should have the opportunity to state whether he ever made such a declaration.

Dr. Sylvester—I am glad of an opportunity to answer this advertisement of Dr. Grant's. The letter professing to give an account of what I said is without a name, and it is a thrust in the dark. It misrepresents what I said on that occasion. In coming to a decision on the Concord, I considered that it would grow from Maine to Missouri. True, I granted that grape cultivators are more particular than the million, but the point was to recommend a grape which the million can have.

Mr. Wm. S. Carpenter.—Having been on that committee, I

would say that we had the subject under consideration more than a year. We judged very carefully, and I am more pleased with the award now than I was when it was made. In considering the claim of the Iona, it was seen that it would not answer for general cultivation, because it is not hardy enough, and in some places it mildews. Of the Concord, Mr. Knox, who is the great strawberry king, and who is becoming the grape king, says it is the best grape grown. Dr. Warder says it is certain to give satisfaction. The Iona succeeds only in certain localities.

Mr. Solon Robinson.—I was one of those who originally recommended the Iona. I thought it the best seedling grape in America. I think so still. And yet I heartily approve of the remarks of this committee. Any one who has room enough to plant a Concord, and sky enough above, can have grapes.

Mr. P. T. Quinn.—I was surprised at this advertisement. I was one of the committee, and for two years I closely examined all the grapes competing for the prize. If I were on a committee now to decide, I would still award to the Concord. The decision has met the cordial approval of skillful cultivators and good judges.

Mr. R. J. Dodge.—Not having been on the committee, I would say that of eighteen choice bearing varieties, I prefer the Concord. Next, I prefer the Clinton; but it must hang till late—even till ice is made; then it really is a sweet grape.

Mr. Nichols.—I have forty varieties, and I find that my family will pick the Concord first.

Mr. A. P. Cummings.—I have a similar experience. While there are nice grapes in my hot-house, my family pick Concords for choice. But I cannot recommend the Clinton. I will not have it on my grounds.

Mr. R. J. Dodge.—The Clinton is used for another purpose, even if the fruit is not good. When grown by the side of other grapes, the rose bugs will leave them and prey on the Clinton.

Mr. Cavanah—After frost comes, the Clinton is very fine; it does not have a watery, spoiled taste, and it is grateful to sick people. It wants plenty of wood. My opinion is, that it will become one of the best wine grapes in this country.

While this discussion was going on, a couple bottles of wine—one Delaware and one of Diana—were opened, and the wine circulated. It was nice foaming champagne, presented by J. C. Davis & Co., made at Hammondsport, N. Y., and specimens of the kind they are sending to the Paris Exposition. Some did not seem to

like the taste of the Diana, and made remarks about it. However, it was soon disposed of.

Mr. N. C. Meeker.—The Diana generally is considered a fine grape. Some prefer it to all others.

Dr. Sylvester.—A gentleman in Massachusetts had a Concord vine on a high trellis, and one winter the mercury went twenty-five degrees below zero. The same season it bore more grapes than it ever did before or has since. The Clinton is adapted to general cultivation. It will grow on poor ground. Pack the fruit in shallow boxes of two layers, and in February it will be good.

Mr. E. Williams.—If I were to plant many vines, I would select the Concord.

Mr. Solon Robinson.—Wherever one can be certain that the Delaware and Iona can be grown, they are the grapes to plant to the exclusion of others. But there seems to be a great objection to them because the birds commit such ravages among them, particularly on the Delaware. Some years they almost destroy the crop. This complaint is general from the Hudson to the Mississippi. Beyond the Mississippi, south of Iowa, these varieties leaf blight so badly that many have given them up. All testify the Concord will grow vigorously everywhere, but as to quality it is not exactly first rate. But with reference to the Concord in the warmer parts of the country, one fact is overlooked, or not generally known. There it rises in quality, and it is so superior that it must be without a rival for many years. At St. Louis it is almost equal to the Black Hamburg, and is highly esteemed for claret wine. The hot sun swells it to great size, and gives a solid sweetness almost equal to choice food.

Combined Churn and Ice-Cream Freezer.

Mr. Pomeroy, East Hampton, Mass., exhibited a combined churn and ice-cream freezer. The dasher is old-fashioned, but is upright, and is moved by a crank which is most effective when used as a lever. In the outside case, hot or cold water can be placed, and in making ice-cream it is filled with ice and salt.

Sorghum.

Mr. Seth Hulbert, East Hampton, Mass., says when sorghum was first introduced, several farmers tried it, but the syrup had a raw and sickish taste, and its cultivation was given up. I still see accounts of people making it, but perhaps they have got a

new way, so that it is better. If this is so, I would like to know it, and in particular if sugar can be made.

Mr. N. C. Meeker.—The only important improvement consists in the use of shallow evaporators made by Cook and many others, variously modified. Without these sorghum would be forgotten. William Clough, editor of *The Sorgo Journal*, estimates the yield in this country at 35,000,000 of gallons a year. This should be worth $15,000,000. Most of the sorghum is made in the States west of New York, and in the South. The yield is very large in Tennessee, Georgia, North Carolina and Kentucky. In Wisconsin, Iowa and Northern Illinois the culture is wide, and extensive machine shops are engaged in making mills and evaporators. Some parties claim they can make sugar and have invested largely. The subject needs to be investigated by scientific and patient men. Commissioner Newton should have invested a portion of that $162,000 Government money in this interest. The crop has become as firmly established as the potatoe. Many families always use sorghum on buckwheat cakes, and the children do not care if it runs over on their potatoes. It is superior for ginger and other plain sweet cakes. Used with good buttermilk, soda and eggs, and wisely baked, it is little inferior to sugar. Although the quality has improved, the best has a slight acid or raw taste. But this is sweetened a good deal by the thought that it is made on one's own land, or in the neighborhood. The children have faith in it that they could not have if it came from New Orleans. Sorghum is considered more healthful than tropical molasses, because it contains all the saccharine substance of the cane. Plantation molasses is a sediment of sugar filtered through animal charcoal, blood, and sometimes poisonous chemicals.

An Industrious Lady.

Mr. Isaac Van Tassel, Manlius Centre, N. Y., says we have a neighbor, a widow lady, Mrs. Mary Hodgman, 66 years old, and in the last year she knit 23 pairs of fringed mittens, wove 500 yards of rag carpeting, 1,000 yards of flannel, and spun eighty pounds of wool, two runs to the pound. This was up to November 1. Up to January 1, she has woven 200 yards more. In the mean time she has taken care of the milk of two cows, and done her housework.

Bee Pasture.

Mr. Quimby, St. Johnsville, Montgomery county, N. Y: "I

would say, in answer to what is good pasture for bees, that, so far as my experience goes, nothing; although it might be a great benefit for the bees to find an abundance of forage at hand, still, it might not pay. It would take several acres, where there are many bees, to produce a few hundred pounds of surplus honey. If but few bees, they would get all they require without the specialty. We might have a few acres covered with borage, catnip, or other honey-yielding plants, and by some peculiarity in the atmosphere, which sometimes occurs, no honey would be secreted, when the trouble and use of land will be a dead loss. Suppose the season is favorable, and the yield abundant, there will be more than the bees can collect, without this cultivation. But when a crop will well pay cultivation, and will also yield honey, there is an advantage, though not quite double. It will, of course, save the bees long journeys. An acre or two of red and yellow raspberries will furnish as much honey for several weeks as any that can be planted. White clover is another plant to be largely sown. It is not as *sure* as the raspberry to yield honey, at all times, yet it lasts longer. Buckwheat, although inferior in quality, is valuable as yielding its honey when most other sources have passed away. When the clover harvest has been abundant, this comes in as an extra, clear gain; and when the clover has failed to yield, it often furnishes the winter stores for the bees. If bee-keepers want two chances of pay for investment, plant raspberries, sow white clover, and, above all, sow buckwheat."

Mr. N. C. Meeker.—Mr. Quimby has the right idea, and we are obliged to him. But there is another side to this subject. The club must consider all sections of the country. Now, there is a very large portion of the United States where bee feed is very precarious. It commences where the grass region ends, and includes almost all the Southern States. There little or no dependence can be placed on white clover, for it does not grow; and there are years when the bees do well if they can live, while surplus honey is not to be thought of. The question arises, whether there is any plant that profitably can be sown in the South which will enable the bees to be productive.

Mr. Cavanach read the following paper on vegetables that are seldom or never seen in our markets, and their modes of cooking:

Sea-Kale.

Sea-kale: Crambe Martima, of Linnæus; Chou Marin, of the

French; Meerkool, of the Germans; and Col. Marina, of the Spanish. The sea-kale is a marine cabbage, growing wild on the seashore in different parts of Europe. It is a perennial and very hardy. In England and Ireland the peasantry flock to the seaside in the months of March and April to cut the young shoots of the sea-kale, which they boil as greens. The precise period of its introduction into the garden is not known. Miller is the first author who notices it, in his dictionary published in 1731; it has now become quite common in the markets of Great Britain. The old method of growing it was to cover the beds with four or five inches of sand; when the young shoots came up, they were nicely blanched and fit for the table. This method is seldom adopted now; boxes or large pots are used instead. Most vegetables, when forced, are deficient in flavor; but sea-kale is an exception. The young shoots that are forced are more tender than those grown in the open ground. It is one of those accommodating vegetables that will grow in any moderately good soil. To cook sea-kale, soak the stalks in water for thirty minutes, and tie them in small bunches similar to asparagus; boil until tender, which will be in a short time, over a brisk fire; drain off the water; lay them on a slice of toast which has been moistened in the water they were boiled in; dress with drawn butter, pepper, and salt, same as asparagus.

Salsify.

Salsify (*Tragopogon porrifolius*) or vegetable oyster, a biennial plant, whose leaves closely resemble the leek. The root is long and tapering, and like all root vegetables it requires a deep and rich soil. It is used as a substitute for oysters cooked in this way: The roots are scraped and laid in water for fifteen minutes to abstract a portion of its bitter flavor; it is then to be boiled until tender, and cut in slices or grated and made into small cakes and dipped into a batter made with flour, milk and eggs; then sprinkled with cracker or bread-crumbs, and fried in boiling lard. The young shoots of the second season's growth, when about four inches high, may be used the same as asparagus. Propagated by seed.

Broccoli.

This vegetable (*Brassica oleracea*) is supposed to have been produced from the cauliflower, which originally came from the Island of Cyprus some three hundred years ago, and introduced into the

gardens of England at that time. It is more hardy than the cauliflower and more liable to produce a crop of flowers; it does not grow quite as large as the former, and consequently requires less room. The purple cape is a late variety. In color it is similar to the red cabbage. The white cape is the earliest. To be successful in growing broccoli, as also cauliflower, it requires fresh ground every year. We have never been successful in raising them the second year in the same soil. Of course, like all the brassica or cabbage tribe, it is liable to be attacked by insects, the most disgusting of which is the small green fly. This little pest creeps into all the crevices of the flower, and can only be ousted by immersing the head in salt and water for a few hours before cooking. Cooked the same as cauliflower.

Artichoke.

Cynarus scolymus, or Globe artichoke. The artichoke is a perennial plant, with large leaves, three or four feet in length, covered with ash-colored down. It is a native of the south of Europe, where it is considered a marine plant. Its name is derived from the Latin word *cinere*, from its being grown on land that was manured with ashes; in general appearance it resembles a thistle; there are two or three varieties: first, the oval—in this variety the scales are straight; the Globe is of a purplish color, and the scales are turned over the flower; it is propagated by seed and suckers of the old roots; the flower-head is the part most commonly used; these must be cut before they mature; they are boiled and the outside scales broken off, dipped in drawn butter, and then used similar to asparagus. This is an epicure's dish, requiring more time to eat than most people are willing to devote to it. The young shoots are also boiled and pickled, and the flowers have the property of rennet in curdling milk; it can also be used in connection with bismuth in dyeing woolen goods a beautiful yellow. The seeds possess a strong vegetating flower, lasting for three or more years.

Brussels Sprouts.

Brussels sprouts, (*Brassica Oleracea*), a rather singular variety of the cabbage tribe; it sometimes grows to the height of four feet; the stem produces an infinite number of small heads, about the size of a walnut; the top of the stem is surrmounted by a large loose head, similar to the Savoy; in Belgium it takes precedence

over all other varieties among people of taste; it is quite hardy, and if planted late in the season and taken up in November, and heeled in some sheltered corner, with a slight covering of salt hay or other litter, it will produce its miniature heads all the winter. To cook, wash well in cold water and boil until tender, then drain the water off and season and stew with cream or drawn butter.

Spinach.

New Zeland Spinach, (*Tetragonia expansa*).—The advantage which this variety possesses over the common kind of spinach is, that it stands the extreme heat of summer, when the other varieties are sure to go to seed. Its leaves are large and very succulent. When it was first introduced into Europe by Banks it was treated as a green-house plant, but its great superiority for summer use was soon found out. It was thought so much of formerly that it was propagated by cuttings. In cooking use only sufficient water to cover the bottom of the vessel, as the leaves contain a large quantity of water. When done lay them in a sieve to drain. Add cream, in which let it simmer a few minutes; when spinach is cooked in this way it is fit to eat, and not otherwise; the great trouble with vegetables in the city is, that they are at least twenty-four hours old before the purchaser obtains them, and in many cases they are a week old; then again, vegetables are frequently sent to market before they are fully grown; unripe vegetables are as insipid and often as unwholesome as unripe fruit. All vegetables being more or less succulent, their full proportion of fluids are necessary for their retaining that state of crispness which they have when growing; on being gathered for use, evaporation commences, and soon the roots or leaves become flaccid and shriveled up; in this state the fibres are less easily divided, and whatever juices may happen to remain, are positively injurious.

Adjourned.

February 12, 1867.

Mr. Nathan C. Ely in the chair; Mr. John W. Chambers, *Sec.*

Buckman's Hay Fork.

Mr. Wm. S. Carpenter, from the committee to examine Buckman's hay fork, made a report, recommending that a trial of horse hay forks be held on March 1. They had procured the barn of Mr. Josiah H. Macy, near Rye Station, on the New Haven railroad, Westchester Co., N. Y.

The report was adopted.

Hutchins' Cider Press.

Mr. Hutchins exhibited one of his combined hand cider mill, wine press, fruit grinder, cheese press and lard press. The proprietor had procured a quantity of apples the day previous, most of which were ground into pomace, and allowed to remain unpressed till the club had convened, when the juice was expressed and distributed and pronounced excellent.

Corn Husking Machine.

Mr. Frank Fuller exhibited the American Corn Husker, and said: "Although it was designed to be operated by horse power, a man could turn it when husking. The machinery performs the work beautifully. The stalks with the ears attached are drawn, butt-end first, between two creased or ridged rollers, which pinch the stalks and stems of the ears so firmly as to separate the ears from the stems, when the stalks and most of the husks pass through between the rollers, and the half-husked ears drop down on an inclined plane and slide forward a few inches, when the husks and silk that remain on the ears are stripped off by means of two revolving belts, and the ears, neatly husked, drop into a basket at the end of the husker."

The principal on which this machine is constructed was thought to be the correct one; yet some of the members suggested that there is a chance for a more perfect development of this principle in cheaper and more durable machinery.

Hunt's Hoosier Straw and Fodder Cutter.

Mr. J. D. Beardsley, 119 Nassau street, New York, exhibited two models of this machine, one of working size. It is claimed to cut a ton of hay three inches long, and in two and a half hours. There is only one knife, which works rapidly, is easily adjusted, and it is so arranged that when a substance which the knife cannot cut gets in the balance wheel it ceases to revolve.

Mr. Wm. S. Carpenter.—It is used in my neighborhood, and is liked as a hand-power. It was noticeable that these machines require power. One knowing what it is to turn a crank at once thought of the hard work. It is true they greatly save labor, but the power is wanted to run them.

Starr's Improved Horse-Power.

Mr. Nicholas Starr, Jr., Homer, Cortland county, N. Y., exhibited a model of this machine. It attracted great attention. Noth-

ing is needed more than a better horse-power. The rail and endless chain affair is as cruel as slavery. This invention is similar to the sweep power, but avoids the friction. A rim incloses the radiating arms, on which runs the chain, and it is applied directly to the pulley which is on the axle of the driving wheel.

In the old horse-power there are from ten to fifteen bearings and three distinct gearings, which of course cause great friction, and from thirty to fifty per cent of the power is wasted in overcoming it. In this there are three bearings and no gearings. One can see how much will be saved. It is claimed that a horse will run it all day in sawing wood, and not be much tired.

Mr. Wm. S. Carpenter.—We are as a people more deficient in horse-powers than in any other farm implement. If this is what it appears to be, it must be of great benefit. But is it in practical operation anywhere?

Mr. Starr.—Yes, and has been for two years. I am a farmer; I had great need of it, and set to work to construct it. I came hither to propose to the club that they appoint a committee to examine it, and I will put it up anywhere they say to do any kind of work, for I am certain it will do all I claim for it.

The subject was referred to the committee appointed to test the hay forks.

McDonald's Railroad Perpetual Brick Kiln.

Mr. John McDonald, Saratoga Springs, N. Y., exhibited a model of this kiln. The green bricks are placed on cars at one end of a long kiln, and worked along gradually until they arrive at that part of the kiln where they are subjected to a white heat. From this point the heat diminishes, and the bricks are allowed to begin to cool, so that by the time the cars arrive at the further end the bricks are all evenly burned, and sufficiently cool to be handled. It takes twenty-four hours for the cars to go through the kiln. They are of three sizes; one holding 60,000 burns 30,000 in a day; one of 100,000 burns 50,000 per day. The inventor claims that this kiln saves three-fourths of the fuel, and produces brick of uniform color and quality. The proprietor assured the club that the invention is in operation, and gives satisfactory success, as none of the bricks are burned too much, and others not enough, as is the case in the ordinary kiln. He had run them in the West Indies, and one was in operation at Saratoga Springs, and another at Croton Landing, on the Hudson river.

O'Neil's Hay Fork, Scoop and Scales.

Mr. J. K. O'Neil, Kingston, Ulster Co., N. Y., exhibited an improved hay fork, which can be sold for $8.

He also exhibited a scoop and scales combined—a common tin scoop, which has a round handle in two parts. When the scoop holds sugar or flour, the handle is divided, and one part suspends the scoop, and presents common spring steelyards ready to weigh.

Fuller & Co.'s Strawberry Vases.

Mr. Solon Robinson, from H. A. Fuller & Co., Norwich, Conn., exhibited specimens of strawberry vases, made of porous earthenware, like a flattened tunnel, to be used in protecting and forwarding the plants. Mr. Robinson said he would like them much better if the price were $3 a hundred instead of $12.

Mr. Thos. Cavanach.—Forty years ago there was a like invention in two halves. They would be useful where there are a few plants, but would be too costly for field culture.

Mr. P. T. Quinn. Rye straw, at 8 cents a bushel, is just as good, and, besides, will manure the ground.

Breeding of Swine.

Mr. S. Edwards Todd read the following paper on this subject:

It is well known to farmers who are versed in the science of hogology, that the pigs of a well-bred and well-fed sow, after they are a few days old, instinctively choose their places at the udder of the dam, each little pig selecting its own peculiar teat; and when they take their food, each one, amid the rush and rough-and-tumble, fetches up in his proper place with as much accuracy as a well-trained family of children come to the dinner-table. The smallest, the runt, or what in common parlance is called the "titman," finds himself crowded to the last teats at the rear end of the udder. If the number of pigs be greater than the number of teats, the weakest pig cannot be reared. We have in mind an instance in which the brood of pigs numbered one more than the teats on the udder of the sow. The smallest pig had no place at the dinner-table. After a few days the little thing, wofully emaciated and sickly, died of utter starvation. In every brood of pigs, in every flock of lambs, in every herd of neat cattle, in every drove of horses, in every nest of birds, in every brood of domestic fowls, in every ear of grain, Dame Nature makes provision for the propagation of its kind, by concentrating the excellences of that

species in one seed or animal, which are to be transmitted to the offspring or products of the race or kind. This is an established and incontrovertable law; and its manifestations are recognized in both the animal and the vegetable kingdom.

In reverting again to the brood of swine, the poorest pig, which corresponds to the shrunken, half-developed nubbin of corn, or to the small kernels on the tip-end of the ear of grain, lives at the rear end of the udder. Pigs reared here are utterly unfit for breeders, whether male or female; because they are destitute of that prolificacy which is common to the pigs that suck the forward teats. Why do many sows of choice breeds bring forth only two or three pigs at one litter, when they ought to produce as many as there are teats on the udder? And why do some sows always drop as many pigs as they are able to rear? In the former instance they show ill-breeding—that seed animals were selected at random, without any reference to their prolificacy. In the latter instance we have the assurance that the dam possesses many of those qualities which a skillful breeder desires to have transmitted to the young stock. Let the "titman" be selected for a brood sow, and choose the runt in her brood for a breeder, and let the titman in the next brood be saved as a breeder, and it will be found that in a short period of time there will be a wonderful degeneracy, which cannot be repaired by the most judicious system of breeding for a decade of years. On the contrary, select the female pig that sucks the forward teat, and continue to choose the "sow pig that sucketh before" for a brood animal, and every year will disclose most satisfactory developments in the form and symmetry of the herd of swine.

Blood will tell. We cannot transcend, nor thwart the established and unalterable laws of the animal kingdom. In the pigs that are reared at the forward end of the udder, is concentrated a greater degree of prolificacy, and greater power to transmit more of the excellent points which constitute the perfect animal, than can be found in any other pigs in the brood. And these are the only ones that ever should be saved as breeders, whether male or female. The second or third pig from the front, may to appearance, be quite as beautiful, thrifty, and make as heavy an animal, when slaughtered, and perhaps heavier; but such swine are not the right ones to select as breeders. It is not the most beautiful animals that can be relied on as breeders; but the ones that will transmit the greatest number of excellent points of desirable form

and symmetry to their progeny. Blood will tell. Like will produce like, to a certain extent.

When pigs of a degenerate stock are kept for breeders, their get will always be inferior to themselves, because they have not the inherent power to transmit their excellent points to their offspring. There is a point beyond which like will not produce like, but the product will be unlike the progenitors.

Farmers who desire to succeed in producing stock of any kind must make themselves familiar with the unalterable laws of procreation and transmission, for they hold good from the highest order of intelligence that exercises dominion over the beasts of the field to the lowest order of quadrupeds. Therefore, be wise to select the pigs for raising your future herd of swine when they are sucking.

Injury to Pear Trees.

Mr. C. S. Locke, West Dedham, Mass., says: During the late storm a stone wall was blown down, and it covered a row of dwarf trees just in prime bearing. As the snow settled, the branches and stones went down, and now the trunks are bare poles. I would ask the Club whether it is best to graft them now with their own wood, or wait and let branches shoot out. They are Bartletts, Dutchess, and Glout Morceau.

Mr. John Crane.—I would not graft with the Glout Morceau. It is not worth cultivation. Because it is a thrifty grower, the tree peddlers have worked it off and cheated the people.

Mr. Wm. S. Carpenter.—As regards this gentleman's trees, much the best way is to let them sprout from the trunk.

Cutting Back Apple Trees.

Mr. Abram Davendorf, Minden, N. Y.: Last fall I set out 200 apple trees. When shall they be cut back?

Mr. Solon Robinson.—We prune too much in the walking-stick form. The practice originated in gardens, where land was scarce. An apple tree would be all the better to start a foot from the ground, when the tops will not be higher than twelve feet.

Mr. W. S. Carpenter.—My plan in setting out trees is to cut off both branches and roots, and more of the former, and annually remove interfering branches.

Mr. R. J. Pardee.—Usually I would cut back at the end of the first year's growth. Then the form can be established; it should be conical and handsome. Still, the tree should start low. Much

will depend on the variety; and in trimming one should understand the habit of the tree in hand.

Dr. Peck.—The gentleman's trees should be cut back this coming spring. If delayed till fall there will be a growth of weak branches. By trimming in the spring, on the bursting of the buds, and letting only the branches required grow, there will be health and vigor.

Mr. Quinn.—Trees take great damage by being planted in the fall. If they are not cut back then, they are too top-heavy for the roots, and they work loose. One should have a clear understanding of the shape he wants.

Peach Buds.

Mr. Wm. C. Davidson, Milford, Kent county, Del., says he has examined with great care a large number of peach buds from various orchards in this county, and finds that at least four-fifths are still perfect, and our winter is such as to justify experienced growers in predicting a full crop of this delicious and profitable fruit. The winter has been the most severe known in thirty years, yet the mercury has not indicated lower than six degrees below zero.

Plant Lice.

Mr. R. Huntington, Amesbury, Mass., says: "I would like to learn a remedy for plant lice, if there is one, as we have some valuable plants completely overrun with them, and we have tried various remedies without effect.

Mr. Thos. Cavanach.—If in a house, fumigation with tobacco is a good remedy. But there are various kinds of plant lice. Some are killed with a wash of whale-oil soap. The little red spider is very injurious and hard to kill.

Dr. J. V. C. Smith.—Spiders always are carniverous, and are our best friends. They are seeking food in some other animal which does the mischief.

Mice in Orchards.

Mr. Samuel R. Downing, Westchester, Pa., writes: I have mixed snuff with soft soap, and washed my young fruit trees two or three times every winter, and now, for three years I have not been troubled with mice or rabbits. I always keep the snow away from the trees. It is a good time now to collect nests of every description deposited on the trees and burn them.

Abortion in Cows.

Lyman B. Sanford, Cherry Flats, N. Y.: This disease, if we may call it such, is increasing every year throughout the dairying region. In Herkimer county it was reported that 8,000 cows calved prematurely in one year. If this be true, one easily can see the damaging effects it has on the dairy interest. A cow which is thus disordered is not worth half as much the next season, and the chances are that she will never come in right. I have known cows thus fail for three years in succession, when they were turned out to fat. For the past nine years I have been keeping from twenty to fifty cows, and have had considerable experience in cows calving prematurely. In the Winter of 1863, out of a dairy of thirty-five choice cows no less than fourteen miscarried between January and March. I had fed corn-stalks up to December 20, and then commenced on good, bright timothy hay alone; it was cut from an old meadow, which had been mowed more or less for thirty years, and contains no Johnswort or other foul weeds. My neighbors have been in the same fix; some loosing more, others less. No one could find a remedy.

Mr. Sanford relates that being in Canada he stated his trouble to an old English farmer, who offered a remedy for $10, which he paid. In explaining, the Englishman said that the grass which grows on old land does not contain the bone-making material to form the calf, all the phosphate being exhausted. The sum of the receipt was: To collect bones, pound them fine, and when the cows are salted in the fall or winter, they must have one tablespoonful of the bone dust mixed with the salt. Mr. Sanford had the bone pounded and kept from the air, and, as directed, he fed it with the salt, once a week.

As a result, not one cow in a dairy of thirty-three cows miscarried, while his neighbors lost, all around him. Nor, since then, has he lost any, except one, caused by getting on a rail-fence and being strained, and he still continues to use the remedy. He adds: "Three of my neighbors tried it last winter, and they did not lose one." I have adopted the plan of feeding wood-ashes, through the summer months, mixed with equal parts of salt.

Mr. Geo. Arnold, Oakland, Livingston county, N. Y: In old meadows where the per cent of June grass is large, it is apt to be smutty, which is of the same nature as the ergot of rye. Cows fed upon such hay are apt to lose their young. I think, if farmers

will root out their June grass, and feed clover and timothy, we shall hear of no more abortion in cows.

Mr. Solon Robinson.—And yet Kentucky cows feed wholly on this grass.

Grape Roots in the Water.

Mr. J. B. Garber, Columbia, Pa.: Some time ago I gave the club an account of grape vines growing finely and producing largely, whose roots stood in water. Last year my Catawbas, Isabellas, and many other varieties on dry ground badly mildewed and made a feeble growth; in short, the vines ripened so poorly that they will require a favorable season to recover. Now, the other vines growing in water were not injured in the least by the wet spell, and most of their roots were under water the year round; the soil is never cultivated, but covered with a sod of grass. The branches and berries were large and of extra quality.

The only Black Hamburg vine that I have ever seen growing in the open air and worth the ground, was a trellis one hundred feet long. They bore full crops of fair grapes, though the foliage was slightly injured, perhaps, by summer cold. Now the trellis of these exotic vines stood within two feet of a drain from the house, which was always moist. Another example of the love of vines for moisture is the Great Hampton Court vine in England, as its main root, it is said, has taken exclusive possession of an old drain. I have Concord and other vines growing within three or four feet of a small stream of spring water which are healthier and show more and better fruit than others growing on trenches and dry ground.

I have been a grape amateur about fifty years, have read all that has been published on grapes, and now, after this long apprenticeship, I confess myself a beginner; this I must say, I know of no books which can be followed with the least prospect of success. I would strongly urge those who have a chance to plant within a foot or so of a running stream to do so, and report to the Farmers' Club.

Seasoning Fence Posts.

Mr. Ephraim Harmon writes: "I have read the reports of the Farmers' Club for several years, and I consider the information contained in them very valuable. I am willing to add my mite. Much has been said and written about fence posts. Some thirty years ago I built a post and board fence. After it had stood about twenty years, I built it over again by taking up the posts and set-

ting them over again. All the posts but five were reset, and a number of them are now standing, and are tolerably sound timber. The trees of which the posts were made were of the hackmatack timber, and from logs near the top of the trees. They were cut down in the month of August and seasoned thoroughly before being set. The posts were set in sandy land, where timber commonly rots quick. I have set much better posts cut in the winter, that have not lasted over five years."

Management of Bees.

Mr. M. Quimby, St. Johnsville, Montgomery county, N. Y.—Reuben Ragan says he "tried every description of patent hive," and has now "fallen back on the old-fashioned box, with a slight improvement." Said improvement, I suppose, consists in cutting the board which forms the top of the lower part of the hive a little short, so as to allow passage at each end for the bees into the honey-boxes in the chamber, which he has "found altogether preferable to augur-holes." I object to this teaching as orthodox, unless he can show cause why it is better, whether he has proved it better in one or a hundred experiments. I have no objection to an augur-hole, or to a square, or other shaped hole, providing it is in the right place, and not too large. I think if Mr. R. would experiment closely, he would find the shape of no consequence. He would also find that *his* passage at the side would be preferable nearer the middle. He would learn that, however well his bees may have done, that they would have done better, had he managed properly.

It is well demonstrated, that whenever a colony of bees are forced into another apartment for room to store honey, they lose a little time, and the more convenient the passage-way, the less time. If it were not for the queen going to the surplus boxes, and using part of the combs for food, it would be policy to open a passage six or eight inches square directly over the main body of the hive. We should get more honey, often several pounds, while if they had to go to the side for a passage there would not be any.

The following is the result of teaching without experience. He says: "If the season is favorable, and the swarms come early, they may be robbed on or about the 1st of July. If the season is not good, present year swarms should not be robbed. Older swarms may be robbed about the same time, but not later." Now my advice to any one that follows this teaching, is to get rid of the

bees at once; he will never get pay in this way. For every pound of surplus he gets before July 1st he will get 500 afterward. The basswood, which produces a great portion in many places, seldom opens a blossom before July 10th, north of 42 degrees. A very little portion of even clover is then secured. And when buckwheat is the main crop, there is none stored in the boxes before August. If, where Mr. R. lives, the honey harvest is all over by July 1st, it is well to remove the surplus honey, but this instruction is not adapted to this section.

I have advised, and shall continue to advise to take all the surplus that is made, or all that you can induce the bees to make. As the bees in a hive of suitable size provide for themselves first, there is next to no risk in taking all they will make, whether from a new swarm or from an old one.

Fruit by Weight and Measure.

Mr. W. S. Carpenter stated that the subject of weighing all kinds of commodities, instead of measuring them, is now being zealously discussed, and he desired to have that subject brought before the club at the next meeting.

Mr. P. T. Quinn.—I hope this subject may be the regular subject for one hour at the next meeting of the club.

The Chairman.—This subject of weighing the products of the farm, instead of measuring them, will be opened by Mr. Quinn at the next meeting.

Adjourned.

February 19, 1867.

Mr. Nathan C. Ely in the chair; Mr. John W. Chambers, Sec'y.

Raspberry.

Mrs. Mary Barker, Gorham, Ohio, asks the club to inform her which they consider the best raspberry.

Mr. Wm. S. Carpenter.—The best raspberry for family use is Brinkle's Orange, but not being quite hardy it requires winter protection.

Mr. Nichols.—I have raised the Philadelphia raspberry several years and I prefer it to all others. Its flavor cannot be excelled.

Mr. N. C. Meeker.—It will do great injury to the club to indorse Brinkle's Orange for general cultivation. During several years travel through the west, I have never seen this fruit in market

except in one place, and that in Springfield, Illinois, and there were only two quarts. I have had it growing over five years, and last year it fruited for the first time, when I had two berries.

Dr. Peck.—I object to Brinkle's Orange because it is not suited to general cultivation. It suckers more than any other variety. In short, it is only suited for a few localities. The Black-cap raspberry is a good bearer, and last year I picked it for twenty-three days.

Mr. Wm. S. Carpenter.—I grant that Brinkle's Orange thrives best on heavy clay soils, and that it might not succeed on light sandy ones.

Dr. Sylvester, Lyons, N. Y.—It does well with me, but there is a superior variety called "The Kirtland," from Ohio. It does not need protection.

Inquiry was made regarding a house for drying raspberries.

Mr. Solon Robinson.—One can be built for ten dollars. Make a furnace with stone, have the flue run along the ground; over this build a rough house, which need not be tight, and have drawers with basket-like bottoms placed within standards.

Mr. N. C. Meeker.—It is a better plan to have a small house well constructed, lathed or plastered or ceiled, with blinds for ventilation when necessary, and have it heated with a stove. Such need not cost over fifty dollars. They are common on the Ohio western reserve, and one eight or ten feet square will dry ten bushels of apples a day.

Dr. Halleck spoke of the ease with which small fruits, and in particular cherries, can be canned in glass jars.

The chairman said he would indorse this. Last year he had fifty jars of cherries put up in plain hot water, and next week he would show specimens.

Mr. Wm. S. Carpenter.—The quince is greatly improved by canning. I wish people would try it, even with one quince, and they will learn how good it is.

Dr. Peck.—Dried raspberries for several years have sold for forty-five to sixty cents a pound, twice the price of raisins, and they can be raised and dried for fifteen cents. People living at a distance can engage in no business more profitable.

Several members called attention to the fact that all our domestic dried fruits sell higher than foreign ones, and that apples are dearer than oranges or lemons. This would show the superiority

of the cold north to the boasted sunny tropical regions for fruit-growing.

Carpenter's Corn Sheller.

Mr. Thomas Carpenter, Battle Creek, Mich.—This device is a board to be placed on a chair, with a spiral sharp-edged iron in front, surrounded by a piece of tin to prevent the corn from flying off. The corn is shelled somewhat in the old method, as when one sits on a board with a case-knife driven into the end. Mr. Wm. S. Carpenter thought it useful to shell corn when it is important not to injure the germ.

Inside Blind Fastener.

Mr. Frank Chase Sutton, New-Hampshire, exhibited a fastener for blinds, to be operated from the inside of the room. This acts by means of a curved rod or wire, which is moved from the inside, and in its movement corresponds to an arm extended through the window; the blinds can remain partly or wholly open, and when closed they are locked. Of course it is not necessary to raise the window. The sash outside will be somewhat defaced.

Miniature Butter Packer.

Mr. W. B. Gurnsey, Norwich, New York, exhibited boxes for packing butter. This attracted marked attention. It is a small round wooden box, made of veneer cut from maple or other hard wood, saturated with a preparation which excludes air and holds two and a half pounds of butter. The plan is to supply these packages to choice dairies, and to send the butter fresh to market and unmixed with that made by others. Often the best butter is made when there are only two or three cows, where everything is neat and convenient, and where the lady will have time enough personally to perform any part of making butter well. Such butter, in such packages, will have a value not easily attained otherwise. Hitherto this quality has been used to bring up the grade of inferior butter.

Tree Planting for Protection on the Prairies.

Mr. Samuel Edwards, La Neville, Buren Co., Illinois: A double or triple row of evergreens as a screen is of equal value for protection with a stone wall of the same height. The day is coming when the general planting of them around stock-yards, houses, gardens and orchards will be common. Eventually they will be

planted on the west side of most farms, which will soften the rigors of winter, and when mature, pay large interest in the timber. It has been thought that evergreens cannot well be transplanted. The only conditions of success are that their roots constantly must be kept moist. Native evergreens from forests sell from $5 to $18 a thousand. Foreign varieties when imported have been failures to a great extent. They are now grown here, and at two years old sell from $12 to $24 a thousand. Those of small size should be planted in beds convenient for watering in case of drouth, and shaded with brush or corn stalks a foot above the tops of the plants—covering the surface of the ground with leaves, straw, or prairie-hay is useful, and a cover over the tops in winter. When firmly established with new and fibrous roots they are to be transplanted for good. I have generally set in rows four to eight feet apart, and two to four feet in the row. In all cases cultivate well, and when eight feet apart plant a row of some hoed crop between for two or three years, till the trees shade the ground, and keep down the weeds and grass.

White, Norway and Scotch, and Norway spruce, in the order named, are the most rapid growers, and most valuable for planting. White pine has made a growth here of four and a half feet in a year. On very dry knolls the red cedar, and on wet soils the American arbor vitæ, succeed. In all cases cultivate well the *early* part of the season. By close planting an upright growth is secured. Thin out in from four to six years, and afterward as they may require. Within fifteen years enough can be taken out by judicious thinning of rapid growing trees to pay all cost of planting and culture.

Lombardy poplar grows readily from cuttings a foot long, planted early in soil well prepared, the dirt pressed firmly on two-thirds of the lower end. Black walnut, button and chestnut, hickory and oaks are propagated by gathering the nuts in the fall before they get dry; mix in layers with dirt of a depth so that all will freeze; plant in April, in nicely prepared ground; cover as deep as the diameter of the nut, either where they are to grow, or in the nursery row, to be taken up the first winter and buried beyond the power of frost. If one-half of the top roots at one year old are cut off lateral roots put forth more abundantly, and are more successfully transplanted.

It is to be hoped that this class of trees will receive attention. The white maple is most valuable for fuel among the fast-growing

trees. Its seeds and the white and red elm ripen in May, and should be planted then. Sometimes such are found in abundance along streams. Tulip white wood comes from Southern Illinois, and sells at about six dollars a thousand. Sugar maple and the ashes mature their seed in autumn, and should be planted then, or mixed with damp sand or mold, to keep it from drying, and planted early in the spring. The American larch or tamarack sell from five to eight dollars a thousand, and the European larch from six to twelve dollars; both grow fast, and are useful for ladders, hay-racks, &c. European varieties are not as hardy or as valuable as our natives.

Mr. N. C. Meeker—Our prairie farmers will be under obligations to the friend of evergreens and hard-wood trees for the suggestions thrown out in the above communication.

Treatment of Poultry.

Mr. C. Taber, Brooklyn, L. I., recommends a close barn, shed, or cellar, with windows on the sunny side, and one opening to let them out when the weather tempts, secures the first condition. With nothing but an open hovel, or the still more open *trees* for them to roost in, with the mercury down among the zeroes, the fountain of eggs is completely frozen up. If the ground is frozen, give them fresh earth occasionally from the cellar, so as to replenish their grinding organs with pebbles. Ashes for them to dust in should also take the place of the dry earth in summer, and they should have meat in some form—the most available of which is the pressed cakes or greaves from the tallow manufacturers. A spoiled liver or other meat from the butcher, boiled and cut from occasionally, is excellent. Then some chopped cabbage or mashed boiled potatoes, with a little corn and wheat screenings or other grain, and a few pounded bones, lime, or oyster shells, with which to cover the eggs, will complete the diet. Feed regularly every morning, and always in the same place. The hens will be found in waiting for their breakfast, and almost before they have finished will run off to the nests for relief. Hot buckwheat cakes are also excellent, and they should have *warm* drink occasionally. It is a great mistake to compel hens to eat snow and ice. Try the above gentle persuasives, and they will reciprocate the kindness, and cackle their thanks as they drop an egg about every other day—at least the writer's have done this in the late severe weather.

Restoring Worn-Out Land.

Mr. C. H. Weidner, Shokan, Ulster county, N. Y.—On this subject we need more light. It is not sufficient to tell farmers to plow under clover, for the value of clover is an established fact, and yet not one-tenth of the farmers use it, for the reason that they do not believe they can succeed. Two years ago this spring I seeded down with clover and timothy a lot that had rye on, which grew well, and when gathered it yielded a heavy crop; yet there was hardly a blade of any kind of grass to be seen. The same season I plowed under a crop of buckwheat in the fall, sowed it with rye, which last June looked so much better than that on an adjoining lot, that I felt satisfied the increased yield would have paid the expense incurred in plowing under the buckwheat. I plowed under the rye, had a boy follow after and drop corn in the furrow, and in the fall the corn was from one to two feet high, which was turned under and again sowed to rye. This spring I will seed it to clover. When the season is over, I will give you the net result of the whole. My advice to those wanting farms is not to go South or West, but to do as I have done, locate a little out of the common course of travel, within a hundred miles of New York city, where can be found a plenty of naturally good land, but by misuse run down, and which can be purchased at the same price as in the settled parts of the West. The great want is better cultivation, and to get the land in the same condition as that of the West. Here prices of farm produce range higher than they do in the city.

I shall try to demonstrate the fact that it will pay to get poor land into a high state of cultivation.

Rye will grow on soils where clover will not start, and because it will grow on poor land it has been raised year after year.

Books for Farmers.

Mr. N. C. Meeker read the following letter from Dr. J. P. Phillips, New Haven, Conn:

"Farmers read and purchase too few books, and often those they do read are not adapted to their wants. I suggest that the Farmers' Club appoint a committee to select and recommend a farmers' library of ten or twenty volumes. Then let arrangements be made with wholesale booksellers, by which they will furnish the entire library or any single volume at wholesale price. This would encourage farmers to buy the best, and would prevent them from squandering their money for worthless sensational books."

The proposition was thought important, and the club voted there should be a committee, and the chair appointed as follows:

Messrs. N. C. Meeker, S. Edwards Todd, Dr. J. V. C. Smith, Wm S. Carpenter, and P. T. Quinn.

Selling Vegetables by Weight.

This being the subject appointed for discussion, Mr. P. T. Quin spoke as follows:

It has always been, and is now, an unsettled point with the farmer, to know how much to give or take for a bushel. The consumer can seldom make any calculations on the length of time a barrel or a bushel of a certain kind of vegetable will last, using the same quantity daily. The size of the bushel is usually regulated by the scarcity or abundance of the article to be bought or sold. Take, for instance, potatoes, one of the staples, and forming a portion of the daily food of all families. When potatoes are scarce, and bringing high prices in market, the producer measures a bushel to suit himself. Master of the situation, he philosophically arrives at the conviction that a man should be well paid for his produce. At such times the measure is carelessly filled and very slightly rounded, and the purchaser certainly gets no more than the law allows. On the other hand, if potatoes are abundant and cheap, the tables are turned—the producer has lost the vantage ground he so lately held. Under these circumstances the farmer has not only to fill the measure carefully, but heap on above the rim of the bushel as much as there is below it, besides occasionally throwing in a peck to make "good measure." This same by-play goes on between the producer and the "middle men," and of course a more adroitly played game has to take place between the latter and the consumer, to enable the "middle-men" to make an honest living, and thus matters "hold out." Who that has bought vegetables for family use, has not at different times been surprised at the relative differences in quantity of different pecks or barrels of potatoes.

How much more simple it would be to place one or a dozen of heads of cabbages on a scale, and sell for so much per pound, than the present method, which is tedious to both buyer and seller. As a general thing, cabbages are not uniform in size or weight. Very large heads are often very light, and except the purchaser is an expert in the business, he is taken in by appearances. Each head has to be the subject of a separate bargain, and, of course,

shrewdness is all-important in each negotiation. In fact, the whole system of selling vegetables by measure instead of weight, places honesty at a discount.

When beets, carrots and parsnips are sold by the "small measure," there can be no accuracy in getting the exact amount to be paid for. These vegetables, when well grown, are two or three inches in diameter at the large end, gradually tapering to a length of from twelve to eighteen inches; every individual specimen being, from its form, a temptation to those packers whose consciences are more elastic than their measures. Barrels of potatoes vary in contents, from two and a quarter or three bushels each. As there is no inducement to pack in larger barrels, small ones are procured. Besides, it is not unusual, upon opening a barrel of potatoes, to find the proof of careless packing in an empty space below the cover. In ordering large quantities of vegetables from a distance, the purchaser is at the mercy of the seller, while, on the contrary, in selling by weight, there would be no room for accident or foul dealing. Orders would be sent for hundred weights or tons, and the form of packages would be a secondary matter. It is no more difficult to sell a barrel of vegetables on a platform scale, than to lift and weigh a bag of grain. There is no reason why vegetables as well as grain should not be sold by weight. Before this law was adopted with the latter, the same difficulty existed that now holds good (or rather bad) with vegetables.

Adjourned.

February 26, 1867.

Mr. Nathan C. Ely in the chair; Mr. John W. Chambers, Sec'y.

Improvement in Buggy Springs.

Mr. D. H. Wood, Sandusky, Cattaraugus county, N. Y., exhibited a model of his carriage spring brace. The object of the brace is to prevent longitudinal rocking action of the body of the carriage on the springs.

The chairman said the brace seemed to have some good points.

Mr. W. S. Carpenter.—The model looks practicable, but we cannot give an opinion without seeing it attached to a carriage.

Spring Wheat.

Mr. B. A. Luker, Sherburn county, Minn., says that he has been in the habit of sowing spring wheat in May, contrary to what has been stated as the best method by Mr. Meeker, and that he was successful; consequently that this wheat does not need to be sown early, so as to be frozen.

Mr. N. C. Meeker.—The statement was made with reference to the wheat crop, which makes Chicago the great grain market. On the prairies it was found that the late sown wheat could not be depended upon. But when sown in February or March, or even so early as January, and even in the mud, if the ground had been previously prepared, the crop was almost certain. The theory is that spring wheat is of the same nature as fall wheat, but that its roots are not strong enough to stand the severities of a whole winter. This practice is the result of experience; if anybody has facts to the contrary sufficient to make a rule, it will be important to have them known.

Hard Pulling Horses.

Mr. Cavanagh.—I would like to know a remedy for a horse that pulls hard by the mouth.

Mr. Wm. S. Carpenter.—There is a safety-rein, which, passing from the bit, goes to a ring in the head-stall, and great power over the animal is acquired.

Mr. R. J. Dodge.—If he pulls so hard, put on forty hundred; or, if that will not do, I will swap, for mine does not pull enough.

Dr. J. V. C. Smith.—The Arabs have a bit made of an iron ring and with a tongue about four inches long, with which they stop a horse instantly. I have seen a whole regiment of cavalry at full speed brought to a sudden stand, and blood run from the mouths of many of the horses. In getting on a horse to ride across Mount Lebanon, I noticed that the rein was a mere thread, easy to break, but I found the least touch was sufficient to guide the animal.

Dr. Snodgrass.—We cannot control our horses in that way, because we are not in sympathy with them. We require muscle and not feeling in our horses.

A member of the club stated that Mr. Wilkes of *The Spirit of the Times* would answer all questions about horses, free, in the columns of his paper.

Pear Trees on Mountain Ash Roots.

Mr. John St. John, Elkhorn, Wis.—A letter was read from this gentleman describing a pear orchard growing on this stock and doing remarbably well. Quince stocks are not hardy in that State.

Mr. Wm. S. Carpenter.—This method has been tried here and failed. The root of no tree is so much subject to attacks by the borer as the mountain ash. The white thorn would be a better stock, but it is not worth much. The quince certainly does well in Illinois.

Poultry.

Mrs. Sarah Brown, N. Y., stated that she had a farm, and wished to know how many fowls can be profitably kept on a place, what are the best methods in caring for them, aud what kinds should one select.

Dr. Peck.—Much will depend on circumstances. The business is uncertain. Some few have succeeded, while the majority have failed. A colored man, near Newburgh, used to make $1,000 a year from his poultry, but how he did it I do not know.

Mr. R. J. Pardee.—I used to get eggs at a cost of four cents a dozen.

Dr. J. V. C. Smith.—A gentleman, near Boston, put 1,000 hens on an island, fed them well and took the utmost care of them, but he never got an egg; all but five or six died, and he was nearly ruined by persisting in his experiment.

Mr. Wm. S. Carpenter.—I keep about seventy, and am very successful. They have laid all winter. I grant that much care and knowledge are required. I provide boxes of dry ashes for them to roll in; this kills lice. I have known hens to die with lice when they had all the corn they wanted. I give vegetables, fresh meat, &c.

Mr. E. Baldwin said he had been equally successful; his hens had laid all winter.

Mr. N. C. Meeker.—While there is such a difference in results, it would seem necessary to have an institution where the science of making hens do well could be taught. My experience is that ten hens are more profitable than any larger number. Perhaps we might know more if we had a hen college.

Mr. P. T. Quinn moved that the subject be laid over for discussion next Tuesday.

Hollow Horn.

Mr. D. A. Ashcroft, West Carlyle, Ohio, wrote inquiring about this disease in cattle.

Mr. Wm. S. Carpenter.—When cattle have moist drops on their noses they are healthy. To cure this disease I bore the under part of the horn with a quarter-inch augur.

Mr. S. Edwards Todd said a preventive is to keep the cattle fat.

New Seedling Potatoes.

Mr. D. S. Heffron, Utica, New York, presented some new seedling potatoes, one called the Harrison, from the Goodrich, which he considers valuable. He showed seedlings of the Cuzco, productive and free from hollowness; also from the Garnet Chili. Mr. H. was familiar with Mr. Goodrich's experiments, and is extending them. He said that a new potato cannot be tested short of four or five years. He gave an interesting account of his labors, which was listened to with great attention, and he received thanks from members of the Club.

Canned Fruit.

The Chairman exhibited cherries which had been preserved over seven months in one of Squires' patent cans, without sugar.

Mr. Squires showed a great variety of canned fruit put up simply in water. Several jars were opened and passed among the members. The precess, though simple, is described in directions given to the purchaser of the jars. The fruit seemed well preserved.

Dr. Hallock spoke of the liability, in most kinds of jars, to break, but this process seemed to avoid accidents; and if so, would be of great value.

Ohio Apples.

Mr. Wm. S. Carpenter presented a very fine collection of apples, grown by Mr. Leach, Madison county, Ohio. The varieties were Peck's Pleasant, Belmont, Wagner, Vandervere, and Ohio Wine. They were cut and distributed, and were pronounced the finest apples ever presented to the Club.

Hand Pegging Machine.

Mr. J. Hamilton Brown exhibited one of his hand pegging machines for boots and shoes.

Prof. Tillman.—This is a very important invention, never

before made public. It is difficult to describe, but it is made of iron and steel, about eighteen inches long, with a small apparatus attached for holding the material for the pegs, which is in a continuous ribbon. It works with a crank, and is held upright with one hand, and it weighs about twenty pounds. It cuts off the pegs, makes the holes and drives them in with great rapidity.

Mr. Brown said that a pair of shoes with two rows can be pegged in two minutes. The advantage over other pegging machines which cost several hundred dollars, is, that in pegging the shank of a boot the machine can be held at any angle, and the pegs driven in straight. Several specimens of pegging were done, and the members were astonished at its results.

Newell's Revolving Harrow and Cultivator.

Mr. Newell exhibited a working model of this harrow and cultivator; it is calculated to put the ground in the most thorough condition for crops, and working on some new principles. It was thought of favorably, and a proposition made for a future trial to test its merits.

Farm and Fancy Gates.

E. & A. Buckman, East Greenbush, Rensselaer county, N. Y., exhibited models of farm and fancy gates. These are very cheap and effective gates, self fastening, without hinges, turning between two slight posts, and working on ingeniously constructed pulleys. One great advantage is they can be opened over snow drifts.

Prof. Tillman considered the construction on true principles.

Mr. N. C. Meeker.—There are gates in use in the west somewhat similar, but they are without fastenings or pulleys..

Slater's Fruit Ladder.

The Secretary exhibited this ladder, which is in two or more sections, extended by cords and pulleys.

Mr. Wm. S. Carpenter, said that he had a ladder similar to this on his farm, which he considered better. It has a hook that fastens the ladders together when the proper elevation is attained.

Butter—Directions for Making.

Mr. Storrs Burrows, South Trenton, Oneida Co., N. Y.—At a meeting of the Club of the Union Agricultural Society, Mr. H. W. Garret gave the following directions regarding making butter which are important, His dairy produces an extra quality. The first is clean milking, with everything appertaining to the entire

process, kept clean, then doing everything at the proper time. Forty hours is the average period of time for a pan of milk to remain prior to skimming. It is necessary for the milk to sour before the entire cream can be obtained. If the atmosphere is such that the cream becomes rancid, immediatly skim. Skimming at the proper time is absolutely necessary. The milk room should be kept at sixty-one degrees. Twice a day stir the cream in the jars: let those jars stand in the coldest place in the summer. When churning is necessary, let the cream be at sixty-two degrees. Use a dash churn, which is superior to any other. When the globules are about breaking, reduce the temperature to 60 degrees. Do not wash the butter. Work it as little as possible; too much working makes it salvy, and washing destroys the flavor.

Adjourned.

March 5, 1867.

Mr. N. C. Ely in the chair; Mr. John W. Chambers, Secretary.

POULTRY.

The chairman stated that as the subject of poultry raising had been made a special subject for to-day, he would give a little of his experience. He had kept thirty hens and three roosters from the 18th day of April to the 1st of November. These hens had laid 1,728 eggs. The cost of feeding them was exactly $17, which was about a cent apiece on an egg. They were fed chiefly on wheat that had got partially wet in transportation, and on scraps of meat. He bought seventeen bushels of damaged wheat at a cost of $17. The value of these eggs was three and a half cents at wholesale, which would leave a profit of about $1 a hen. The hens were the Black Spanish, white-leg Dominicos and the Golden pheasant. He had a good warm house, facing the south, the front mostly of glass. He had pounded oyster shells and gravel kept within their reach all the time.

Mr. E. Baldwin, New Haven, Conn., said that cleanliness, warmth and proper food were the three principal requisites for the successful raising of fowls. His hen-house was about twelve by twelve feet. He had it constructed with a double roof. The hens roost on the upper one, and the lower one caught all the droppings, thus keeping the floor below clean. He had fed them in the winter time with fresh meat. He had about sixty to one hundred chickens.

Mr. Thos. Cavanach.—It depends upon the variety of the hens whether they could be kept with profit or not. He had had Brahmas for the last three or four years; they were a fine looking fowl, sometimes weighing from ten to twelve pounds, but they were the most unprofitable kind a man could keep, on account of their unproductiveness.

Mr. J. N. Nutler, East Bridgewater, Mass.: I have a barn cellar thirty feet square; one-third is used for a henery. The hens have a warm place lighted by windows. I keep fifteen, and have a good supply of eggs all winter; during cold weather from three to six a day, and now from seven to ten. Each morning I give them one quart of meal mixed with hot water; in the afternoon a quart of corn, sometimes pork scraps; keep water by them, also old mortar and clam shells. The cost of eggs does not exceed eighteen cents a dozen. The variety of hens is the White Leghorn, which I prefer, because they are good layers, and seldom want to set, but they are tender and must be kept warm. I think ten enough to keep together, unless the inclosure is quite large, and I shall reduce my flock when the safety of the garden requires they shall be shut up.

Fruits for the Family Garden.

Mr. Thos. Cavanach then read the following paper:

Grapes.

Four of the best grapes for general cultivation—first, the Concord, for hardiness and productiveness, is without a rival; Hartford Prolific is valuable on account of its earliness, ripening about the 15th of September. The only fault it has is its tendency to drop its berries when fully ripe; for flavor, Delaware and Iowa; in favorable situations the Catawba is nearly, if not quite, equal in flavor to the Iowa.

Raspberries.

Brinkle's Orange is a beautiful berry, in color a rich golden yellow; for flavor it is unsurpassed; the worst that can be said of it is, that it is not perfectly hardy; in exposed situations it will need to be laid down and covered with earth in the fall; for profit the best varieties are the Doolittle Black Cap, Philadelphia and Hudson River Antwerp; these are hardy and extremely productive; the thornless Black Cap is quite an acquisition; the ladies need no longer be afraid of torn dresses or scratched hands.

Blackberries.

Wilson's Early berries.—Of medium size; the chief advantage it possesses over its rivals is its earliness, ripening ten days earlier than any of the other varieties. The Lawton is too well known to need any recommendation in its favor.

Kittatinny.—We have failed to find any marked difference between this variety and the Lawton, except that it ripens quicker, and can be used when it is black, the former requiring more time to fit it for use.

Strawberries.

Of all the cultivated fruits there is none more difficult to make a selection from. Some like a tart berry, others a very sweet one. In selecting the following six varieties we think both will be suited: Wilson and Green Prolific, both tart berries, very hardy, and extremely productive; for flavor, Brooklyn Scarlet, Agriculturist, Monitor, and Boston Pine. If we were going to add another to the list it would be the Hooker, an old and well known berry. It is said to be tender. We have not found it any more so than many others in our collection of over eighty varieties.

Currants.

Versailles, the best red currant in cultivation; berries full as large as the cherry currant, but not so acid. White grape, the best white currant for the table; it is sometimes called Imperial Yellow, and when this latter variety is ordered from a nursery, the white grape is sent instead; in fact there is no purely yellow variety. The fruit of all the white currants when fully ripe turn yellow. Black Naples is not a very popular variety. Its peculiar smell has not gained it many friends in this country. For medicinal purposes, and for jams and jellies it ought to be more extensively grown. It generally brings a higher price in market than any of the other varieties.

Gooseberries.

Houghton, very productive but small; the only thing in its favor, is that it is free from mildew. Downing, a decided improvement in American gooseberries; these two are the best of all the native varieties. The English kinds are very apt to mildew in some situations, yet we have grown them for a number of years and never have been troubled with it; if grown in sandy loam, where there is good drainage, there will be no trouble from this

disease. Crown Bob, White Smith, Sulphur Yellow, and Red Champion—this lot will give variety enough for any family.

Cherries.

Governor Wood, an American seedling of good flavor, beautiful color, yellow with red cheeks, ripens early in June. Black Eagle, the best black cherry, ripens first week in July. Napoleon Bigarreau, a very large and firm fruit, yellow and red and of a good flavor. Black Tartarian, an old popular variety, very productive, flesh juicy and of a good flavor, rather apt to suffer from the rot, ripens the middle of June. Downer's Late Red; fruit of medium size, fine flavor and very productive, the best red cherry ripens in July; for preserving, there has been none as yet, found to supersede the May Duke, it commences to ripen its fruit the beginning of June and continues until July.

Pears.

Bartlett, Flemish Beauty, Bonne de Jersey, Shelden, Lawrence, Glout Morceau, Vicar of Winkfield, Urbaniste, Columbia, Duchesse, Beurre Clairgeau and Beurre Deil; these are all well known popular favorites, and the fruit commands a good price in our markets.

Culture of the Alanthus Tree.

Mr. Wm. R. Prince, Flushing, L. I.—Some persons have striven to raise an unjust prejudice against this tree, on account of the unpleasant ador of the blossoms, and have referred thereto as applicable to all ailanthus trees, whereas it applies only to the female or seed-bearing trees, the male trees exhaling no odor whatever. In planting, therefore, it is simply requisite to obtain trees of the latter class. But few persons seem to be aware of the fact that it is one of the most important trees in Japan for the silk culture, and that its foliage furnishes food for a very large species of silk worms, whose product is so extensive that all of the poorer classes in Japan are clad with the silk it produces. In France this tree is very extensively grown for the same object, and its congenial silk worm has been obtained from Japan. A few years ago I sent fifteen barrels of the seed to France to fill an order from silk growers in that country.

Black Knot in Cherry Trees.

Mrs. E. C. McClaughny, Deposit, N. Y.—I have often thought of giving the Farmer's Club the benefit of my observations with

regard to the black knot on plum and cherry trees, but have always deferred it. Mr. C. W. Cook, of West Wrentham, Mass., professes to have discovered "the primal cause of the black knot in small grubs found lying in a curved line across the pith of the limbs." I think he is mistaken in saying that is the first cause, or, indeed, the cause at all, of the black knot. We have one cherry tree in our garden, which was a very small, unthrifty looking one when we come hither four years ago. It then had a few black knots on, which I cut off, but I did no more, thinking it would die. Last winter I concluded to experiment, and in February I had the house slops poured around the roots, and continued till the buds started. When it blossomed it was a perfect mass of petals, and most beautiful to behold. It was the first time it had blossomed full since we owned it. It grew very fast, looked thrifty, and I thought I should have a good crop, till one day I thought I saw a large green worm on one of the lower limbs, but on closer examination found the outside bark had burst, and what I supposed the worm was the bright green inside bark. I called for my husband to look at it, and we found several of the limbs burst in the same way, with no sign of bug or worm, or insect of any kind about the tree. The leaves and fruit were beginning to fall off, and we concluded it had been over-stimulated. My husband took his knife and scarred the bark of the body of the tree from the lower limbs to the root, and before we left it had split open an eighth of an inch, and the gash is fully half an inch wide, well barked over. The bursts which I have just cut off in the form of black knot have injured the tree some, but I hope by watching it closely, and taking good care of it, to have a nice tree of it yet. I always feel very much interested in the reports of the Farmers' Club, and if what I have written will contribute to aid in solving the mystery of the destroyer of the plum and cherry, I shall be very happy to feel that I have been able to give some ideas where I have received so much information.

Remedy for Girdled Fruit Trees.

Mr. B. Updyke, Johnson's Creek, Niagara Co., N. Y.—Apply melted grease or rosin; it readily cools on the tree; no binding up is necessary. Put it on with a narrow strip of a shingle. I have saved many in this way. Some five or six of my neighbors' trees that were girdled with an axe in the hands of some scamp, and thoroughly, too, taking off the wood with the bark for a

space of six or ten inches, were saved by this method, and now they rank with the best in the orchard. This wash should prevent the mice gnawing trees.

Adjourned.

March 12, 1867.

Mr. N. C. Ely in the chair; Mr. John W. Chambers, Secretary.

The chairman read a letter from Mr. D. W. Whiting, Pacific, Franklin county, Mo., twenty-five miles southwest of St. Louis. The region is described as producing all kinds of grain and in particular fruit. Mineral lands yielding iron and lead can be had cheap. Still, farming is at a low ebb, as many farmers buy potatoes and other vegetables in St. Louis. Eastern men would do well there to raise such things for market. A sample of tobacco accompanied the letter, which was very fine. It took a premium at the St. Louis Fair of a silver pitcher worth $300, and besides sold for six dollars a pound.

Mr. A. G. Bisbee, Chester Cross Roads, Ohio, sent grafts of very choice apples, which were distributed among the members.

Growing White Pine.

Mr. N. C. Meeker read a letter from Mr. Eben Clark, Haverhill, Mass., inquiring where the seed of the white pine can be bought, how it should be planted, and at what time.

Mr. Wm. S. Carpenter.—The seed is sold at all large seed stores, but a majority die during the first year. It is a good way to sow broadcast with oats or some other grain, that they may have shade.

Hen Manure.

A correspondent in Brooklyn inquired how best to use hen manure.

Mr. Wm. S. Carpenter.—It should be mixed with some fertilizer to absorb the ammonia. Plaster is as good as anything.

Mr. J. C. Thompson, Staten Island. — Plaster costs money. Ordinary dry soil, the dryer the better, will absorb the ammonia, and it can be applied on the surface, to the hills, or broadcast. It is as good as any guano.

Dr. Peck—I have experimented ten years in composting strong [illegible] first put in solution, and when I use night soil I add half of muck or common soil, and I make poudrette at a cost of fifty cents a barrel. Make a trench two feet deep near running

water, and put in the mixture, add water, work together with a hoe, and in four days it is so thoroughly decomposed no fermentation will follow. Otherwise, a year or so is required.

Dr. J. V. C. Smith.—I noticed in my travels through Egypt, that on the banks of the river Nile, up to the first cataract, a distance of nearly a thousand miles, there are a multitude of towers about ten feet high, and on the tops of these are built up pots one above another, ten feet higher, which are doves' houses; and here are kept enormous numbers of doves solely for their manure. Often I saw the women carefully climbing up these pots to scrape out the manure, which they sell for the growing of water-melons. Once, when our boat stopped, an Arab sold to some party aboard a quantity of two quarts for about three cents. The finest melons growing in the world are raised by this means.

Sugar Beets.

Mr. W. J. Coleman, St. Louis, Mo., writes: "More than once I have raised fifteen tons of sugar beets to the acre, and I did not think it a large crop. On the same kind of land they will produce as much as carrots up to a certain limit. Their large leaves require so much space that carrots will excel them in a full crop of 1,600 bushels, or forty tons per acre, such as we sometimes raise here. Some of the largest yields of sorgo have been in this vicinity, showing that the climate and soil here are suited to the growth of sugar-producing plants. No attempts at making sugar have as yet been made, but among the industries which soon will throng Lake Erie borders, this should not be neglected."

Mr. N. C. Meeker.—This letter is important in showing the capacity of a soil not remarkable for richness, in producing the beet. There is a vast extent of country through the Northern States where this root will grow equally well. In view of the recent success in beet sugar, in Illinois, this subject is of the very greatest importance. At the time they commenced grinding at Chattsworth, the Illinois Central railroad sent down to the works some of their most ingenious machinists; and there were orders, that if at any time it was necessary, a special train should be run, that there might be no delay. This they did, not because they had invested a cent in the enterprise, but because they believed beet sugar could be produced, and that it would add immensely to the resources of the State.

We have with us, to-day, a gentleman well versed in the manu-

facture of beet root sugar; and I introduced to the club Mr. E. B. Grant, who has visited the principal beet sugar establishments in Europe.

Mr. E. B. Grant.—I beg to present to the club some beautiful specimens of beet sugar made in Illinois. I believe that one ton of sugar like this sample could be produced in Illinois, which, at present prices, is worth $350. An acre of beets will prodnce as much sugar as an acre of cane, and can be cultivated and worked up in half the time. Wherever wheat and corn grow, the beet does well. It is adapted to all the Northern States. Beets richest in sugar, so far as he had experimented, were grown five and a half miles from the City Hall, at Hackensack; the yield was 17½ per cent. Of refining sugar, that from the beet will produce 22 per cent more than from cane. However, the molasses from beet sugar is not fit for use, and is made into alcohol; but the pulp is valuable for feeding stock, while the refuse of cane is worthless. At the present price for labor, beet sugar can be made for six cents a pound. This supposes the perfection of machinery and the successful operation of the works, which is solely a question of mechanical business.

Mr. J. C. Thompson said he could raise forty tons of beets to the acre, and, by extra pains, fifty tons. One should begin early, and plant two feet each way. He could show a medal received from the American Institute as a premium for the largest crop of beets grown in this country. Some weighed thirty pounds. This crop was grown on Staten Island. Whether such large beets are better for sugar than smaller ones, may be a question.

The chairman thought the prospect before us a bright one. There is no reason why American enterprise should not equal the European, and when we make not only our own sugar, but all our clothing, iron, and every species of manufactured goods, we will be a happy people.

French's American Corn Husker and Picker Combined.

This machine was exhibited before the Club, and corn on the stalk was husked in a satisfactory manner. The stalk with the fodder and corn being drawn forward by a roller, the ear is picked off, when it rolls into the interior of the machine where a series of rubber rollers perfectly take off the husk and silk and each is delivered separate, one in a basket and one on the floor. When worked by one horse, and at its best rate, it is claimed to husk a bushel in two minutes. Price $50.

Mr. Carpenter thought the machine not entirely perfect. The reply was that all the machines of this kind are of recent invention and cannot be expected to be perfect. Even to this day there is no mowing machine perfect.

Mr. S. E. Todd.—I think this machine is a perfect husker and that it will work a revolution.

The inventor stated that he had husked corn with the machine in several places for different farmers as steadily as if in sawing wood.

The Chair.—The machine does its work very well. There need be no more cold fingers.

Mr. N. C. Meeker.—It is well known in the west that corn husks sell as readily as the corn itself. They are brought to Chicago in bales, and can be seen every day along the streets. They are used for making paper, the same as rags. A few years ago there was quite an excitement on the subject, and it was supposed they would take the place of rags; but the labor required in preparing them was so great that only a few farmers send them to market. This machine seems to supply the great want, and is likely to be of vast importance.

The Chair.—I see that Gov. Fuller of Utah is present, and as he has paid attention to the subject, perhaps he will make some remarks.

Gov. Fuller said, that through the Austrian Consul in this city, he had learned some important facts regarding utilizing corn husks. For fifteen years the Austrian government has experimented on this material, and at Vienna they have built the most extensive paper establishments in the world; besides there are two private ones which are reported to have made a fortune, and they are running night and day to fill their orders. Neither use rags, they are confined wholly to corn husks. In addition to paper they make cloth, for the husk has a fibre, and they produce crash and bagging, which, when worn out, can be made into paper, and a part of every soldier's equipment is of this material. The paper is of every quality, from the finest tissue to packing and wrapping paper; it takes any tint, it makes a quality superior for drawing either with pencil or in water-colors, and it is extensively used for stenographic writing. In its nature it is firm and durable, insects do not prey upon it, hence it is valuable for bank

notes, bonds, legal writings, and parchment documents. Recently it has been found superior in photography.

Gov. Fuller stated that if the husks of the corn crop of this country were converted into paper, they would be worth over a hundred and seventeen millions of dollars; but now they are wasted, and instead, we are using filthy rags, which in some places scatter, by their infection, disease and death. He spoke of many other uses for paper stock, for instance a species of paper mache has been applied to gun boats, and it resisted a cannon ball, where thick iron plate was pierced.

All the various kinds of paper and cloth mentioned were exhibited; the paper is very firm, and that used for parchment of great firmness.

Planting Apple-Seeds and Growing Them.

Mr. D. W. Kauffman, Des Moines, Iowa: I put the seeds into a barrel, submerge them in water previously heated to 150 degrees, let them steam twenty-four hours, then put them into small boxes (boot-boxes) mixed with sand, one bushel of seeds, and a half a bushel of sand, set them in the shade, or on the north side of a building to freeze; then cover with snow well packed, to keep them frozen until the ground is ready. The seeds will sprout too early if not kept frozen. In this way I have had the very best success. Last year I treated nine bushels in this way, and raised nearly 500,000 plants. I have just put up twenty-five bushels in the same manner, and have ten bushels more to prepare. To plant them I procure new land, no matter how far from home, or what rent I am charged (old land will not produce good stocks), plow it deep, harrow it, sow broadcast a bushel and a half to the acre, harrow and cross harrow, or in other words I put them in in just as I do wheat. Last year the cultivation cost about $50 for nine bushels. On old land it might have cost six times as much. I hand-weed and use a hoe where I can. When seeds are drilled, unless very thin, they make but small stalks the first year, whereas to sow them broadcast they grow twice as large.

A New Gate.

Mr. C. G. Caulkins, Ashtabula, Ohio, sent a model of a farm-gate by another party, which is opened by one sitting in a buggy, and which is very ingenious.

Adjourned.

March 19, 1867.

Mr. N. C. Ely in the chair; Mr. John W. Chambers, Secretary.

Concord Grape.

The chairman read a letter from Mr. Bliss, Secretary of the Warsaw Horticultural Society of Hancock Co., Illinois, stating that they reaffirmed the decision of the committee on the Greeley prize for the Concord grape. They say it possesses all the good qualities ascribed to it by the committee.

Mr. N. C. Meeker.—I will state for the information of those who do not know whether the fruit-growers of Warsaw are good judges, that I visited the place last spring and made a thorough examination. It is about 200 miles above St. Louis, on the upper Mississippi. The town is handsome, and on the hills surrounding it, grapes everywhere are planted. I had visited Cincinnati, Cleveland, the Ohio Lake Shore and the Islands, and nowhere had I seen better cultivation or more thorough knowledge of grape-growing, or better wine houses or wine than at Warsaw. They are intelligent, industrious, and have smart children.

Sheltering Manure.

Mr. J. W. Orr, Carlisle, Pa., asks if it is proper to keep manure dry, as a neighbor of his built a shed over his barn-yard to preserve his manure, and then had to open places to let in water.

One of the members stated, that when he was accustomed to use barn-yard manure, he protected it from the storms of rain and snow, and from the sunshine, and kept it from heating by pumping the liquid manure from a cesspool, and sending it to various parts of the yard in conductors.

Mr. J. G. Bergen thought that it is a question whether it would pay to shelter barn-yard manure.

Mr. R. J. Dodge thought it was a useless expenditure of time to erect sheds over coarse manure.

Mr. W. S. Carpenter said, in winter, evaporation is so slow, that very little if any of the fertilizing portions, are lost by evaporation.

Mr. Isaac Hicks, L. I., thought that if farmers had lumber given them, it might pay to cover their manure. But, ordinarily, it would be a losing operation to purchase lumber for building manure sheds.

Mr. W. S. Carpenter stated, that some farmers have been to

the expense of constructing manure pits. He thought they should be careful to convey water into the manure, to keep the entire mass so moist that it will not "fire fang."

Trial of Straw-Cutters.

On motion of Mr. W. S. Carpenter, the same committee that conducted the trial of hay forks, were empowered to make arrangements for holding a trial of feed-cutters, at the barn of Mr. Josiah H. Macy, Rye, Westchester Co., N. Y, on Friday, April 5. The invitation is extended to manufacturers in other States, as well as in the State of New York.

Farming in Iowa.

Mr. J. W. Stibbins, Fonterella, Iowa.—Ten years ago I moved from New York city, where I was born and lived till forty years old. It cost $130 to move, and I took my furniture. I bought a team for $428, a farm at $5 an acre, and paid half down. I started with $1,300; I was a carpenter. The first year we had to work out and live on what I had left, but my family all united with me. Now I have six horses, thirteen head of cattle, Chester hogs, sheep, etc.; and last year I raised 1,200 bushels of corn and other grain. When we came the railroad was two hundred miles distant; now it is forty miles. There were no school-houses in the county; now there are twenty-five. I am out of debt, and, knowing city and country life, I think it would be a good plan for many mechanics in New York to come west and get farms.

Foreign Poultry.

Mr. A. M. Halstead, Rye, N. Y., brought in a trio of Crevecœurs, and placed them on the table. They are said to excel the Black Spanish for laying. These birds were just imported from France, and he has none for sale. Their great excellence consists in their value for laying large supplies of eggs. These fowls were large black fowls, and are said to be very quiet, and not disposed to scratch up grain and plants in the garden.

Mr. Halstead said so far as his experience goes, the Brahmas are the most profitable fowls for eggs and the table of any fowls that are generally raised. He spoke of the dispositions of the Brahmas as being unusually mild and peaceable when confined in a close yard. When other fowls would fight, these would dwell in peace and quiet.

Comparative Value of Hens and Ducks.

Prof. Tillman read a paper on a trial made in France on the comparative value of hens and ducks. The number tried was three of each. During the year the hens laid two hundred and fifty-seven and the ducks six hundred and seventeen eggs.

The Chair.—It is not stated how much damage ducks did to young vegetables.

Mr. Wm. S. Carpenter.—It is my experience that ducks do not lay one-third as much as hens.

Mr. E. Baldwin.—The number tried is too limited.

Dr. Saxton, Brooklyn.—Where ducks live by the side of salt water and get plenty of food they will produce many eggs.

The Chair spoke of a duck he brought in from his farm in the country and kept it entirely alone in a barrel; one year it laid forty eggs, the next seventy.

Fruit-Preserving Houses.

Dr. J. V. C. Smith spoke of fruit-preserving houses suitable for a family, which he had seen in Boston, and he intended to construct one for himself. They are on the principle of some refrigerators.

Mr. Wm. S. Carpenter.—Such are in use in this city by butchers, but as there is a great waste of ice they are too expensive to be popular.

The fruit-preserving houses erected by Prof. Nyce are coming into extensive use.

Dish-Washing Machine.

Messrs. Hannum & Clark, Homer, N. Y., exhibited a machine for washing dishes. The apparatus is of the size of a large tub, containing a wire rack on which the dishes are placed; there is a device similar to a revolving fan; it is claimed it will wash four dozen plates, or two or three dozen milk pans, in ten minutes, and require no wiping, and never breaking any. The cost for those of galvanized iron is $15, of wood $8. It is on castors, and the dishes are run from one room to another.

Mr. John G. Bergen.—This looks very well, and for hotels must be very useful. But no common family would want it. I have fourteen in my family and can get along well without it.

Mr. R. J. Dodge.—It will take from one to two hours to wash dishes in such a family.

Mr. N. C. Meeker.—I presume the gentleman does not know what it is to wash dishes. There are men who do. They know that it is disagreeable, and is an everlasting round. If this machine is what it claims it will be welcome in many families. We should encourage whatever will lighten woman's labors. Many women have hired girls because washing dishes makes their hands black. I am in favor of anything that will make white hands, if the hands will work.

Dr. Peck.—Some women have hands permanently disabled by coming in contact with hot and greasy water. It produces salt-rheum, and year after year they keep their hands tied up with cloths.

Mr. John G. Bergen.—I have several Irish girls at my house; they wash dishes, but I never hear of their having the salt-rheum, while my wife and daughters have it.

Mr. R. J. Dodge.—It is notorious that Irish girls and women, generally, who do the house work have sore and cracked hands. As to salt-rheum, it is known that many diseases are hereditary.

Springs for Heavy Wagons.

Messrs. La Bow & Campbell, Jersey city, exhibited a model of a new spring for heavy wagons. This is a new device, made of cross bars, with rubber at the ends, by which a wagon can be kept level in loading; the elasticity is claimed to be superior, and is cheap. As only a model was shown, and as the subject is important, a committee was appointed to examine them in use on a wagon, and report to the club. The chair appointed Messrs. Carpenter, Meeker and Todd.

Cream Strainer and Refiner.

Mr. Brimier, Cortlandville, N. Y., exhibited a cream strainer and refiner. It is so constructed as to save the cream that goes off with the buttermilk. Often, only a part of the cream is churned, and there are white caps, all of which are strained through a cup in the bottom, with small holes in the sides, and which retain all hair, strings and flies. It is claimed to make more and better butter, and to prepare the cream for coming in less time.

Mr. Wm. S. Carpenter.—This is not exactly new; still it has advantages. I have one myself which is similar.

The strainer was referred to Mr. Josiah H. Macy to report.

Sizes of Drain Tiles.

Mr. W. H. Bishop, Toledo, Ohio, inquires: "In draining wet upland, say a four acre lot, what sized tiles are best and cheapest?"

Mr. N. C. Meeker.—Four inch tiles for the main drains will carry a large quantity of water, and will be found sufficiently large for conveying all the water that would be collected in a wet place for fifty or one hundred rods. The arms or branch drains may be made of two inch tiles.

Several of the members suggested that if there are numerous branch drains emptying into the main drain, the main tiles should be five or six inches in diameter, in order to carry all the water.

Maple Orchards.

Mr. Cyrus Baker, Whitney's Point, N. Y.—Maple orchards are of great value to farmers. More attention should be paid to growing young maples by nursery culture or otherwise. They readily start from the seed. I would recommend those making maple sugar to preserve the first run for family use. It has a flavor peculiarly excellent.

Mr. N. C. Meeker.—This advice should have a wide application. Whatever is choicest and most valuable should be saved for family use. Sort over a few barrels of the best apples, have the children pick out the largest eggs; when corn is to be ground, select the best ears, and carefully fan and reserve the plumpest wheat. Pick out the cheese which has the choicest flavor, lay by the whitest clover honey, and salt down the healthiest, tenderest, and best fatted beef and pork. Build up civilization and refinement at home; the children will prize it, and when they have homes of their own they will know how to do it. This course will establish an aristocracy and a nobility honorable to free America. Second and third quality productions are to be sold. If city people do not like it, let them have land of their own, and be equally rich. But no matter how good an article you may sell, it will not be retailed pure. First class productions are used only for adulteration, to raise the grade of inferior articles. A family living on the best, and in good houses, will make more money than by taking up with scraps and leavings. This is agreeably to a law of human existence. Second-class food produces second-class ideas, which are weak, and second-class men, which are weaker.

Sheep Shedding Wool.

A correspondent at Bethel, Vt., inquires what are the causes of sheep losing their wool, and if to withhold salt would be a remedy.

Mr. N. C. Meeker.—Sheep which are poorly kept oftenest lose their wool. The complaint is very rare with good flock-masters. Salt does not cause it. Some have said that feeding corn heavily produces this result. This may be true when corn is fed in the winter for the purpose of recruiting sheep which are run down. One having no more than ten sheep should get Randall's Practical Shepherd.

Sowing Seed.

Mr. E. S. Smith, Hammondsport, Steuben Co., N. Y.—With over twenty years' experience, I believe the true principle in broadcast sowing is to throw the seed all one way. This may be done by using the left hand at every other cast, which is much easier after a little practice. Choose a strong wind and throw your seed with the wind. Instance—supposing the wind to blow from the west; place your yargetts at the north and south sides of your piece to be sown. When facing the north yargett, sow with the left hand, and vice versa. You will at a glance perceive that seed can be sown faster on this principle, especially all small seeds and oats, which, with a strong wind, can be sown sixteen or twenty feet in width at a cast; but the great advantage is in having your grain come up even. I have frequently set those to sowing, on the above principle, that had no experience whatever, with perfect success. Sow from a basket or pail. Sow plaster the same way, but where you can consistently, drive your team with one hand and sow with the other from a wagon or sled, a man with team will sow forty or fifty acres in a day in this way.

A Cheap Cistern.

Mr. W. J. Robbins, Pleasant Valley, Nebraska.—Farmers are enslaving their housekeepers by using hard water, when a small outlay will build a cistern. Any able-bodied man, with a little ingenuity, can do the work himself. First, dig a hole, circular—say eleven feet across and two or two and a half feet deep; now strike a circle on the bottom of this seven feet across, and dig seven or eight feet deep, digging straight and smoothly down, and shaping the bottom like the large end of an egg; get one barrel of water lime and some good sharp sand; mix two and a half measures of sand with one measure of lime of the right consist-

ency for plastering, put a bucket full of the mortar in the bottom, spreading it around say two inches thick, lay a board or flat stone sixteen or eighteen inches square in the mortar, and plaster on the clay from a quarter to half an inch thick on up to the shoulder left in digging, being careful to round the corner of the shoulder off, so that the weight of the top will not burst off the plaster. Let the first coat dry twenty-four hours, then put on a second of the same thickness and kind of mortar; now procure two sticks of burr or white oak, or any lasting timber, say six or eight inches over and ten feet long, flat one side, to lay on the ground down on the shoulder, lay them twenty inches apart across the middle; make your curb twenty inches square and four or four and a half feet high, and nail it in between the timbers. Fill in around the curb on the shoulder with timber, boards, &c., making it tight, so that dirt will not work through; fill up around the curb with dirt, a little above the surface of the ground. To drain properly, let it stand a week, and you will have a cistern that will hold water enough for any common family.

To Prevent Mice Gnawing Fruit Trees.

Mr. Henry Clarke, Dorrville, R. I.—Cut down forest trees when the bark will peel, a trifle larger than the fruit trees, carefully peel off the bark in sections eight or ten feet long, then saw them into pieces as long as the snow falls deep, and place them around the trees. Then make a mixture of clay and cow manure, with a sprinkling of sulphur, like mortar, and apply to the roots. Do this in June; at the end of the year remove the mortar, and, if necessary, apply new bark. This will keep off mice, borers, and insects generally. The bark also protects young trees from the heat of the sun while they are young.

Basement Stables.

Mr. W. H. Bishop, Toledo, Ohio, asks the judgment of the Farmers' Club as to the healthfulness of stables in the basement of a barn.

Mr. S. Edwards Todd answered that stables in the basement of a barn are quite as healthy as stables above the level of the ground, if they are kept properly ventilated and cleaned. The great objection to stables in a basement is, there is not sufficient attention paid to ventilation. Stables in the basement of a barn are always cooler in the summer for stock, and warmer in the winter,

than those that are constructed on a level with the ground. If they are not properly ventilated, as the side walls are usually air tight, they are unhealthy places for any domestic animals.

Adjourned.

March 26, 1867.

Mr. Nathan C. Ely in the chair; Mr. John W. Chambers, Sec'y.

Cobwebs and Spiders.

Mr. Burgess, Glen Cove, L. I., presented a brief communication on the importance of protecting cobwebs and spiders, as these little animals will destroy a large number of noxious insects.

Dr. Snodgrass said cobwebs are narcotic. Cobweb tea is an excellent nervine—a tea for quieting the nervous system.

Removing Hay without Waste.

Mr. A. W. Burroughs, Hughsville, Penn., desired to know how hay can be removed from one mow to another, without picking it to pieces, thus exposing the hay to the drying influences of the weather, by which a large proportion of its value is lost.

Mr. W. P. Peck, stated that the gentleman can find relief by the use of Sprout's combined fork and knife, with which hay could be removed from the mow in large squares, without exposing it to the drying influences of the weather.

Mr. W. S. Carpenter, said this fork worked as well as the one which received the premium, but it was thought liable to injure those operating it.

Flower Seeds.

Mr. George L. Dinsmore, Bruce, Ill., says: The plan of distributing flower seeds of the club has made many western homes lovely and heavenly. Whole neighborhoods have bloomed. I am making experiments with wild fruits, the results of which I will give in the future. Experiments are needed in all parts of the country.

Improved Water Pipes.

Dr. D. D. Parmelee exhibited sections of block-tin pipe encased with lead. Where water runs in lead pipe only a part of the time, it is likely to become poisonous, and this is called "accumulative poison," for though it accumulates by atoms, every atom remains in the system, and seldom passes off by secretion. The diseases

produced are muscular, paralytic, cholic, &c., and have been known since the time of Cæsar, who prohibited the use of lead pipe. Such diseases have increased since the introduction of the Croton. Still, as the pipes are shorter than in the country, the danger is less, because they can be easily supplied with fresh water. In the country, where pipes are long, or where they freeze, or where the stream is small, the danger is increased. The price of the new pipe is about the same as lead pipe, because though the block-tin is dearer, it is lighter.

The Chair.—Paralysis is said to be another disease, arising from lead poison.

Dr. Peck.—Leading scientific men assure me that when water flows through lead pipe, the carbonic acid in the water produces a soluble oxide of lead.

Mr. Wm. S. Carpenter.—Many members recollect the discourse of Professor Bartlett before the Club, and his statement that his brother lost his life by the cause referred to. Still, I know of families who have used water from lead pide for twenty years and are perfectly healthy. I think we ought not to be alarmed. But it will be a good plan always to let the water run a while from the pipe before using.

Dr. Peck.—Some people are so obstinate that they continually take poison and yet will not die. Such are arsenic-eaters and habitual drunkards.

Mr. N. C. Meeker.—I know of a family where the father and mother died, and I always suspected the cause was the lead pipe which brought water from a spring. I have noticed that very soft water running through lead has a sweet, suspicious taste.

New Wire Clothes-pin.

Mr. W. S. Doty presented a new style of clothes-pin, made of copper wire bent into a peculiar clasp form, so as to embrace the line and hold the clothes more securely than can be done with the ordinary wooden pin.

Catawba Grapes—Mode of Keeping.

Mr. R. H. Williams exhibited a box of Catawba grapes grown and preserved by Mr. D. S. Wagener, Pultenay, N. Y., and read the following mode of keeping them, as sent to the Club by Mr. Wagener:

"I submit to you my plan for saving grapes and other fruit. The room I use is in the basement, and differs in no essential point from any good fruit room. What I claim as essential in

keeping fruit is to have the air in the room pure, dry, and at or near the freezing point. I effect this by means of a fan-blower so enclosed and operated as to pass the air of the room through an ice chest, or shelves loaded with ice, a sufficient number of times to produce the desired effect. By this arrangement I have been enabled to save my grapes with the bloom on, seemingly as fresh as when on the vines. When this arrangement is carried out as above, it will prove a success."

Mole Trap.

An ingenious mole trap, made of iron, for catching moles as they pass through their runs, was exhibited. The discussion then turned upon the utility of moles, and it was evident that those men who advocate the extermination of moles do not really know whether such animals are an injury or a benefit to farmers.

Mr. John G. Bergen stated that moles had done much damage on his farm, as they had taken out his young corn.

Mr. Thos. Cavanach said moles were very injurious to seed beds, as he knew from experience.

Mr. Wm. S. Carpenter thought that the moles were a decided advantage to the farmer, as they destroy large numbers of grubs which are injurious to vegetation. He thought that when moles work among the roots of plants they were in pursuit of insects, or worms, and not after the roots of vegetables.

Mr. N. C. Meeker said he had some experience in the injury done by moles. He did not know whether they did or did not do injury. But it is evident that where there are moles, there is mischief done. Perhaps mice do it.

Mr. Dodge.—Moles are carniverous and never feed on seeds or vegetables.

Col. Harris.—I have seen moles take twenty rods of young Osage orange.

Mr. Dodge.—The truth is they were after the insects which destroyed the orange.

Mr. Lawton said he had never before heard that moles are of any benefit to any one. He had always found them a serious annoyance in burrowing in the earth where he had lawns.

Rhubarb Wine.

By a vote of the club, Mr. W. J. Sheldon, of North Guilford, N. Y., a gentleman interested in this subject, was allowed to take the floor, for the purpose of explaining the excellence of this kind of wine. He stated that he has submitted the wine to the most

eminent chemists of the country, and the result is that there is not a particle of free oxalic acid in it. He said those men who have denounced this kind of wine know nothing about it. He thought this a valuable product of the farm. It is as harmless as milk, and can be made for thirty cents per gallon.

Considerable discussion followed as to whether the rule should be suspended so as to have the wine handed around.

The Chair.—It is unfortunate that the great friend of rhubarb wine is not here to pass on its merits. He is now in Florida. Of course I refer to Solon Robinson.

Mr. Wm. S. Carpenter.—Mr. Robinson has disapproved of this wine from the first. Now I do not call it wine; it is simply a cordial. I will state what I know. Hundreds of barrels of rhubarb wine have been brought to this city, and it is only sold to mix with other liquors, principally to make champagne. Instead of its being profitable it will only bring from twenty-five to fifty cents a gallon.

Mr. N. C. Meeker.—We have a gentleman present from a celebrated wine district, where much attention has been paid to all classes of wine. His judgment should guide us. I would introduce Col. Harris, of Cleveland, editor of *The Ohio Farmer*.

Col. Harris.—I have been familiar with this wine, and with the attempts at making it for ten or twelve years. It originated as such in Ohio, but it has failed except with those who have the plants to sell. There is a short season when it is two or three years old, and then it is a passable drink, but after that it does not keep.

Mr. J. R. Sypher.—A house divided against itself cannot stand. When wine-makers dispute regarding the poisonous qualities of different wines temperance men rejoice. For we believe that all the various drinks, beer, cider, wine, which in any degree intoxicate, have evil tendencies. Even if made pure, the retailer will mix and adulterate, and the only sure course is to touch not, taste not.

To Make Fruit Trees Bear.

The chairman read a letter from John Casey, Seneca Falls, N. Y., who says: In the fore part of April I draw a circle two and a half feet from the tree and around it, then dig a trench the width of the spade, cut off all the roots, and fill with good soil. Then I slightly slit the first bark on the south side down to the ground, thin out the limbs, and prune to two blossom buds on each limb.

Col. Harris.—When I was a boy there was a tree in my father's orchard which would not bear. Having a little hatchet I tried the plan of that young gentleman, George Washington, who could not tell a lie, and I hacked at the tree to the best of my ability. There were two important results. When hauled over the coals, I, too, was not able to tell a lie, and I got a good thrashing; the other result was, the tree ever afterwards hung full of fruit.

Use of Manure in the West.

Mr. R. Snell, Sharon, Muhaska Co., Iowa: The idea of L. D. Whitmarsh of Des Moines, Iowa, and others, about manure, has a tendency to discourage young farmers from thorough and systematic cultivation. In my opinion a man who receives a rich and fertile farm from the hands of his Creator, and by mismanagement wears it out, should be regarded as an enemy to his country, and as a public nuisance. My land is not inferior to any in the State, and although new is benefited by manure, as proved by an increase of crops. I not only use the manure made at my own yards, but think it pays well to gather up that which is cast out by the villagers. In order to have it become food for plants it must be well mixed with the soil, a particle of manure to a particle of soil. It is of little use to throw it down in heaps and to depend upon the plow for spreading it. Mr. W. does not say that he has proved his theory by experiments, but I would like to join with him in the attempt and compare notes next autumn. An account of my operations last year also may "amuse" him. My farm contains only 100 acres, not quite all of it brought into cultivation. The following table will exhibit its chief products with the cost of raising them, viz:

520 bushels of wheat at $1.45 and $1.85	$852 56
400 bushels of oats at 30 cents	120 00
105 bushels of potatoes at 50 cents	52 60
1,400 bushels of corn at 30 cents	420 00
12 tuns of hay at $6	72 00
Sorghum molasses and buckwheat raised upon shares, my part free of cost	76 80
Total	$1,593 55
Cost of hired help until harvest, including board of same	97 16
Total	$1,496 40

Addition work done on farm by same hands, viz :

170 rods of good board fence	$24 00
Breaking four acres prairie	16 00
Planting trees, raising vegetables, drawing and spreading manure, &c.	

From the above, seed, harvesting, threshing and blacksmith's bills would have to be deducted. I have passed my seventieth year, and cannot be expected to do a young man's work.

Canning Fruit.

Mrs. Lot Cornelius, Locust Valley, Queens county, L. I.: In answer to an inquiry as to the best method of canning peaches, I give one that has proved successful for several years past. I prefer the Millville quart glass jar, Whitall's patent. For as many jars as the vessel will hold in which I boil them, I prepare bags of quilt just large enough to slip them in easily; across the tops sew strong straps to be used as handles to lift them from the boiling water. Should the vessel be considerably higher than the jars, let the straps be long enough for a rod to pass through them and rest on the top of the vessel. Let the fruit be fully ripe, pare, and take out the pit with a fork, drop them in the jar the cut half down, until you have as many jars filled as you boil at one time; slip them in the bags, lay the covers lightly on the top, place them in the vessel filled with cold water nearly to the tops of the jars, and put them over the fire to boil. Prepare a sirup of half a pint of water to a pound of sugar (three pounds of sugar and a pint and a half of water will fill four jars if the fruit be mellow and the jars closely filled). When the water boils around the jars, have your sirup also boiling hot, with which fill the jars, and let them boil ten minutes, after that lift them out in a pan, place the rubbers in the groove, press the glass covers down firmly with the hand, put on the clamp, screw it down just tight enough to prevent leaking—which can be ascertained by laying them on the side. Slip them from the bags, lay them on the side, on a piece of quilt or thick blanket, and cover them closely till cold, place them in a dark closet or wrap each jar in thick dark paper to exclude the light. Fruit thus canned will remain good for years. The quilted bags are to prevent the jars from hitting each other or the sides of the vessel while boiling. The quilt or blanket and covering are to prevent them from cracking by cooling too rapidly.

Phifer's Improved Plow and Cultivator.

Brearly & Seaman, Trenton, N. J., exhibited a model of this plow and cultivator, which they claim will do a great variety of work, even to sowing cotton; was in use last year: is a gang plow; works corn, potatoes, &c. A committee was appointed to see it work and report. The chair named Messrs. J. A. Macy, Mr. Carpenter and Mr. Todd.

Farm Gates.

Mr. J. Hibbard, South Butler, N. Y., exhibited a model of a farm gate. This seemed an improvement on my other gates and attracted attention.

Messrs. Dixon & Close, Port Byron, N. Y., also exhibited a model of a gate. This gate is easily opened while one is on horseback or in a buggy, and for a nice affair hardly can be excelled.

Burr Millstone Dresser.

Mr. J. H. Gray, Boston, Mass., exhibited an exceedingly useful and ingenious machine for dressing millstones, or for holding the "pick" while the dressing is being performed. The pick is secured in one end of a handle, the rear end of which turns on a straight, round rod, which enables the operator to trace a line on the face of the stone with the greatest accuracy.

It was stated that millstones dressed with such a tool will make a greater percentage of flour, as the grinding edges are more perfect and will consequently grind more perfectly.

The chief difficulty in dressing small portable millstones which are employed on the farm, is the want of practice in handling the mill-pick. But with such an arrangement unskilled farmers can dress their millstones about as true as an expert in such business. The device is durable and by no means expensive.

The Chair proposed that it be referred to Mr. Hecker, the largest miller in this city, and that he report to the club.

Mr. E. Baldwin, of New Haven, thought this would be of great use in finishing flag stones where nicety is required.

A Steam Plow.

Mr. George Willard, No. 614 Hudson street, N. Y., exhibited a model of his steam plow, and explained the parts, and stated that a working model is in the process of construction. It has been examined by scientific engineers and mechanics, who speak of it

highly. It has several important features, which will be found of great use when plowing ceases to be done by horses.

Distribution of Seed.

The secretary of the club, Mr. John W. Chambers, reports that he has sent out during the winter, to over twelve thousand applicants, more than sixty thousand packages of seed. All who have written to him have been supplied. If any of the applicants have not received the seeds the fault is not his.

The Rev. Samuel Griswold, of Conn., has sent to the club three thousand packages of choice flower seeds to aid in this laudable object. The club has also received a large quantity of seeds from ladies and others for the same purpose.

Adjourned.

April 2, 1867.

Mr. Nathan C. Ely in the chair; Mr. John W. Chambers, Sec'y.

Plastic Slate.

Mr. W. Mallory, Bucyrus, Ohio, inquired if he could employ plastic slate advantageously, by plastering a house outside and in with common mortar, that is employed for making inside walls, and cover the outside wall with plastic slate?

Mr. Allen, who has had some practice in the use of this material, stated that, employed in this manner, plastic slate would be a satisfactory success. He said that there have been many very poor roofs made with this plastic slate, yet the fault was not in the slate, but in the manner of using the material employed.

Mr. W. S. Carpenter.—I have recommended this article to my friends, without having experience in it, and a gentleman at Long Branch covered an expensive house with it, and in a few months it leaked so badly it was ripped off. I think there must have been some mistake in the material, or in putting it on.

Mr. Solon Robinson.—The costly Masonic Temple at Boston is covered with it, so also are many houses in this city.

The chairman stated that there is no other subject connected with building which is discussed by all classes of citizens with so much anxiety as the materials of which the roofs are made. Every week, more or less letters are received from all parts of the country, from farmers, who are inquiring about this kind of roofing.

The Cashmere Goat and its Wool.

Hon. Israel S. Diehl, who is about to sail for Asia, under an appointment of the General Government, for the purpose of learning more than is known in America concerning this goat, and the manufacture of its wool into wearing apparel, was invited to occupy a few minutes in talking about these useful animals. He stated that about eighteen years ago, there was an importation of eighteen of this kind of goats. They have been scattered all over our country, and have been crossed with the common goats, until there are thousands of them in almost every State, from Massachusetts to California. They produce the finest fleeces of any of our domestic animals. He said also, that the fleece of these goats can be produced of a quality possessing more beauty than is common to those fleeces that are produced in Asia. These animals can be reared for $5 per head, and they yield from three to six pounds per head. This material commands from $5 to $6 per pound. In some localities at the west, these animals have increased in value as high as $1,000 per head. Prof. Diehl exhibited numerous specimens of hair of these goats, which was exceedingly beautiful, and some of the specimens were fifteen inches long.

Prof. Diehl has been authorized by the Agricultural Department at Washington, to make a report on the Cashmere goat as he finds it in Asia, and to examine the Asiatic mode of manufacturing their fleeces into cloth.

Mr. N. C. Meeker stated that he has a friend in Illinois who has been accustomed to raise this kind of goats, and they do so much damage that they are really a nuisance. He stated also, that it was exceedingly difficult to dispose of their fleeces in a satisfactory manner.

Mr. Solon Robinson.—These goats should be in a country where there is nothing else, no garden, no fruit-trees, flowers, vines, crops or fences. Then they will do well. Florida would be a good place for them.

Rinderpest.

Dr. Rufus King Brown then delivered an address on the Rinder pest, which was listened to with attention. The following are a few notes: This disease originated in the Steppes of southern Russia, where it always exists in a chronic form, and where it was known in the third century. During the middle ages it devastated

the herds of Europe, and in the fourteenth century, occurred fifty times. Since then, this disease has destroyed 300,000 in one century, and in all about 900,000,000, and it has increased as Austrian and Hungarian troops moved westward. It is similar to small pox, but differs from pleura pneumonia. It was first described a hundred years ago. There is a diminution of appetite, a slight aversion to green food, next to all kind of food, which is on the third day: when a cow, it ceases to chew the cud, there is a decrease of milk, the looks are depressed, the ears are cold, there is increased pulse, the gums of the lower jaw, in particular, are livid, a mucus flows from the eyes and nostrils, mixed with flakes, which coagulates.

The disease is contagious, and is due to a specific material substonce like the virus of small pox, but more malignant, and which the microscope discovers. Dogs, sheep, and even hens, searching for grain, transmit the poison; an attendant carries it in his clothes and even in his hair; water channels, and running stream, and even the public road on which infected cattle are driven, are vehicles for this virus. A single Hungarian ox spread this plague first, into all parts of Italy, then into France, England, and western Germany. No other disease kills so many; generally 60 per cent die, but in England the mortality was 90 per cent. On some English farms, where all the cattle were in sheds adjoining each other, 97½ per cent of those attacked died. The only remedy, till recently, was to slaughter, and then completely bury the carcase. In this way Prussia remorselessly has stamped it out. This virus has been kept for months, and been made active by vaccination. Now, the first cases of vaccination generally are fatal, but it lessens as it passes from one to another, till finally, it disappears in the fourteenth subject.

Dr. Brown then showed diagrams of the virus enlarged 2,800 times, which almost opened the wonders of the invisible world.

There is no remedy, but a preventive, which is pure carbolic acid, freely cast or sprinkled about the abodes of the cattle. Carbolic acid destroys the contagious particles. Prevention by vaccination refers to the steppe oxen only. This virus is not to be confounded either with infusoria or animalculæ; nor has it any analogy to the "ferments." It is active, or living, in the sense of multiplying by division, and is the highest and most deadly type of contagious or infectious matter.

It was also moved and voted that Dr. Brown be invited, at

some future period, to talk on the suject of trichina. Dr. Brown stated that he would respond next Tuesday. By a vote of the Club, the five minute rule was suspended; and one hour designated as at the disposal of the speaker, after he commences his lecture on the subject of trichinosis, on April 9.

Allens' Scuffle Hoe.

Mr. G. P. Allen, of Conn., exhibited a scuffle hoe. This is serrated on each side as deeply as a saw mill saw; it is worked as one walks backward, and from the appearance looked as though it would be useful.

Florida Fruit.

Mr. Solon Robinson, who has just returned from Florida, brought with him specimens of oranges and lemons of immense size, some of which weighed one pound each. He stated that he saw orange trees in Florida that produced several thousand specimens of fine fruit.

In answer to the inquiry about farms in Florida, he replied, there are no farms. There were a few gardens on the peninsula, but properly no farms.

The price of potatoes in Florida, and everything else, is the price of such things in New York added to the freight from this city to that place. Although that is a country of oranges and lemons, the inhabitants do not raise enough for their own use. Oranges were selling for eight and ten cents each in Florida, while such fruit sells in New York for one and two cents each. There is an abundance of Government land there at $1 to $1.25 per acre. Florida is a vast wilderness.

There is no such article as cultivated grass in that State. Yellow clover is indigenous to that country. Mocking birds are a nuisance there, as they destroy most of the fruit. It is the most lovely climate in the country.

Pruning Grape Vines.

The subject of pruning vines, and what constitutes vines of a first, or second, or third class, was called up, whereupon Mr. R. W. Holton, Haverstraw, N. Y., was invited to the black-board to show, by rough diagrams, how any grape vine that has a space of six feet square may be made to produce ten pounds of grapes annually. He cuts off the stem of the vine about ten or twelve inches above the surface of the ground; then trains one arm to

the right and the other to the left, about three feet, in a horizontal direction. About every eight or ten inches on each of these arms a cane is trained vertically, and each one allowed to produce one or two bunches of grapes.

He stated that when a vine is transplanted the stake should always be driven into the ground before the roots are spread out, so that the stake may not injure or displace any of the fibres.

In answer to the inquiry as to what is a merchantable, first-class vine, he brought with him a few vines to show the difference between a first-rate vine, that will sell for $1 or more, and such vines as are sold for eight or ten cents each. The former had a small stem, and almost a complete mat of strong roots ; the second and third class vines have only a few roots, and sometimes it is difficult to make a vine live because the roots are so few.

Mr. Wm. S. Carpenter thought close pruning likely to result in failure ; that vines should grow eight or ten feet long for bearing wood, and that these complicated methods are not suited for the common people or for large vineyards.

Mr. B. W. Holton.—Some vines need more pruning than others, and must have it, if success is to be secured.

What Direction is Best for Rows.

Mr. H. Murray, Clay City, Clay county, Ill., asks : In what direction should rows run to receive greatest benefit from the sun. Some say from east to west ; others from north to south. A long stack of grain running from east to west always will sprout on the north side ; if running from north to south it will not sprout on any side.

Mr. N. C. Meeker.—This subject was thoroughly discussed by western grape-growers a few years ago, and elaborate calculations were made. The conclusion was, that to receive the greatest heat the sun rows should run a few points east of south, because the heat being greatest about two o'clock P. M., the sunlight then directly will shine into the rows.

Feeding Bees.

Mr. M. Quinby, St. Johnsville, N. Y.—The past season was a very poor one for honey in this, the eastern, and many other States. A great many bees starved. Last spring was unfavorable ; a great many through this section lost their bees as late as the middle of June, after using old stores, which, at this time (April 1),

were quite abundant. Stocks are now light. If the weather is favorable through the spring all will go right; but should changeable weather occur and cut off secretions of honey, they must starve unless fed. They should be frequently examined to ascertain their true condition. With the movable comb hive, the exact amount of stores may be seen at any time, by simply lifting out the combs. Do not depend on any amount of bee-bread to sustain them; they must have honey or a substitute. If no honey is on hand to feed, good sugar may be dissolved into a syrup about the consistence of honey, and poured into some of the combs; a small stream, when held at a proper hight, fills cells readily. With the box hive it is more difficult to ascertain their true condition, and when they have to be fed it must be done differently. A shallow dish, set on the top of the hive, with some means possible for the bees to creep into it readily, and fine straw, shavings, or some floating matter, to prevent drowning. One or two holes should be opened on the top for a passage to the honey. Trail a little over the side of the dish and down through the holes to teach them the way. Cover with a close box to keep away outsiders. Just at night is the best time. After feeding has once commenced it will be required steadily, as they use more in nursing the brood. Feeding is not lost by any means, even if not required to prevent starving. The colony will be in condition enough better to pay, providing it has been done judiciously enough to prevent robbing. All the advantages of a good, thrifty cow, in early spring, over one desperately poor, may be realized in a thrifty swarm of bees over a lean one. Avoid excess even in feeding, and do not neglect them.

Improved Bridle Bits.

Mr. R. R. McKnight, Ontario, Ohio, writes, in answer to an enquiry concerning bridle-bits for a "hard bitted" horse, that he had a pair of bits mads by a common blacksmith, which subserve an excellent purpose. The bits have a joint in the middle, similar to the jointed round bits; and instead of being round, are made four-square, having the corners filed up sharp. No difficulty will be experienced in managing a horse with such a bit as this.

Six Best Varieties of Potatoes.

Mr. N. Hobert Yates, Orleans county.—I desire to know the best six varieties, in their order.

Mr. Wm. S. Carpenter.—In answer to the question I would say that the following are the best six varieties of potatoes :

Early—Early Goodrich, Titicaca, Shakers' Fancy.

Late—Harrison, Gleason, Calico.

Adjourned.

April 9, 1867.

Mr. Nathan C. Ely in the chair ; John W. Chambers, Sec'y.

Distribution of Seed.

The chairman distributed a quantity of seed to the members. These were sent by the Hon J. W. Chanler, M. C., and Mr. James Brown, the banker, of this city ; also a very fine variety of winter squash, raised by himself.

Paine's Surveying Measure.

Mr. G. M. Powell exhibited one of Paine's surveying measures. This is a circular brass box containing a steel tape weighing the same number of ounces that an ordinary surveyor's chain weighs pounds, not liable to rust, and is literally accurate. Also, a gardener's measure of similar construction. These inventions looked as if they were great improvements, and we understand are used by government and other surveyors.

Silver's Patent Broom.

Dr. Peck exhibited Silver's patent broom, which has been greatly improved. The proprietors make the brooms themselves. The cap is made from a flat plate of brass, by a singular process, is stamped into a circular cap holding the brush together, and a broom in use can be taken apart and put together without injury. Farmers can make their own brooms with the cap and screw when their old ones wear out.

Revolving Carpet Sweeper.

This valuable labor-saving implement, consists mainly of a revolving brush, secured in a tin frame, which is moved over the carpet, when the revolving brush collects all the loose dirt, and deposits it in a box by its side. It is claimed—and it is philosophically true—that such a sweeper will not wear out a carpet half as much as a common broom, as the action of the brush is so light, and yet it is sufficiently heavy to gather up the loose dirt.

Raw Bone Fertilizer.

The Chairman.—We have received a number of letters making enquiries touching the difference between flour of bone and raw bone superphosphate. These letters having been referred to Mr. Todd, I now call upon him to report.

Mr. S. Edwards Todd said: There is a great difference in value as a fertilizing material, between the flour of bone made of bones that have been boiled several times for the purpose of driving out as much of the oleaginous matter as possible, and the raw bone superphosphate produced from bones that are reduced to powder without extracting the oleaginous material. The raw bone superphosphate is made without subjecting the raw bones to any boiling, baking, or calcining. The unbleached bones are first crushed by powerful machinery, then treated with sulphuric acid, which dissolves every fragment. These two articles—raw ground bones and oil of vitriol—when mingled with pulverized guano, constitute this commercial manure. When bones are boiled to death, and ground into flour, their value as a fertilizer is greatly impaired.

If there is any one practice among American farmers, for which they deserve sharp rebuke, it is for permitting such immense quantities of bones to be exported for the improvement of the agriculture of foreign nations. Thousands of tons of bones are collected annually in Chicago, Buffalo, New York, and other populous cities, and shipped to European countries to fertilize the land for raising turnips, wheat, fat cattle and sheep. And yet American farmers, in stupid quietude, look on and say: "It don't pay to collect bones and apply them to the soil."

It will pay. They have not tested the application of ground bone. There is not a meadow nor a pasture in the land—with very few exceptions—that will not be greatly benefited by a dressing of ground raw bone. Thousands of acres of the best farming land in New England are in a low state of impoverishment for the want of a liberal dressing of raw ground bone. Such fertilizing matter is the very life of the soil. European farmers understand and appreciate this fact. They know it pays to ship bones from America to enrich their farms. The value of every ship load of bones that is picked from our land cannot readily be computed in dollars and cents, to the agriculture of our country. England delights in her own fatness, produced on the choice cheese of American dairies, while we mutter and grumble over a pot of the

whey. Europeans rejoice over the rich, sweet American butter, while we are so unaccountably stupid as to be satisfied with the buttermilk. Our farmers dig and delve, and rake and scrape their grain fields, meadows and pastures, to get phosphatic fertilizers to send to Europe to produce big crops of turnips, and then grumble and denounce their own land as good for nothing because their turnips refüse to grow as they do in eastern countries. The truth on this point is, American farmers must save and apply more manure to their impoverished land; especially must they save bones for growing a crop of turnips. As soon as we can produce a bountiful crop of turnips we can grow wheat. Wheat and turnips in England go hand in hand.

Remedy for the Garget.

Mr. Henry A. Dwight, Northampton, Mass., inquired if the Club could inform him of a radical cure for the garget? And can the milk of a cow nearly dry, in consequence of distemper, be restored except by parturition?

Mrs. Worden, wife of a dairyman in Otsego county, N. Y., said her husband was accustomed to give pieces of "scoke root" to cows having the garget in the udder.

Mr. S. Edwards Todd said that the garget proceeds from different causes. Consequently a different remedy is necessary in each case. When a cow has the garget soon after she has come in, the remedy suggested by Mrs. Worden is a good one. A piece of "scoke root," or poke root, as large as a person's two first fingers, sliced thin, and mingled with the feed, will be sufficient for one dose in a day. But when garget in the udder proceeds from the kick, with a big boot, of some ill-natured milker, or from the udder's having been hooked or bruised by some other animal, repeated bathing with cold water and manipulating with the hand, will be the most effectual remedy. It is almost impossible to restore the milk of a cow to a full and abundant flow after she has become partly dry by disease, until after she has dropped another calf.

Trichinæ.

Dr. Rufus King Brown delivered an address on the Trichinæ which was very instructive. The following are the points made in the doctor's discourse:

Trichinæ or Death by Flesh Worm.—The accounts of disease and death by this malady are true, but have not been correctly

stated. Some have written without having any knowledge of the facts as known to accurate observers. Trichinæ are neither animalculæ or infusoriœ, but are very minute worms. They are not in water or in the air, but are found in the flesh of swine, particularly in the lean part. The female or mother trichinæ while in the intestine are released from the envelope or capsule in the pork or ham, and give birth to broods of young trichinæ. It is these young, not their parents, which work their way through the side of the intestine and thence into the tissues, particularly the muscles. This animalculæs never do. The trichinæ do not cause fatal sickness by eating their way, nor do they exist by devouring the tissue.

Trichinæ have killed many persons in various localities in Germany. Groups of cases occurring at one period are called epidemics, caused by the common practice of eating raw ham, by eating minced pork, as sausages, and as these forms of meat are cheap we see the cause why the disease is more common here than elsewhere. The skepticism arising from the fact that comparatively few persons who eat pork die of this disease is, to say the least, stupid.

Only a small percentage of swine are infected with trichinæ even where epidemics have occurred, nor do all persons infected die. Some parts of a swine's flesh are more likely to be infected than other parts. Of those who eat the same pork, some die, others are only sick. In a cure, a great part of the trichinæ, if not all, become stationary, and then are inclosed in a little spindle-shaped cell, or capsule, of lime. The pig is the only animal which men eat that is thus infected. There have been cases where butchers have denied that the meat they sold contained trichinæ; to prove it, they eat the meat and died.

Thirty-two years ago this capsule, not the released worm, was observed by several anatomists. It is similar to the rain worm, and it is the only worm infesting the body which causes death. In 1815 a person had this disease and recovered. In 1863 he had a tumor on the neck, and on removing it the shells of the trichinæ were discovered.

A trichinæ mother has a hundred of living young in her body; after bearing them she still continues to breed more. If one contains 200 young, and there are 70,000 of these mothers, we may judge of their numbers, for so many may be contained in a few morsels of meat. It is the young alone which spread through the

body. In the dead body of Mr. Bemis, Linn county, Iowa, from 180,000 to 261,000 were found in pieces of muscle less than an inch square. One may have trichinæ in the body without any serious illness. Where there are only a few he will scarcely perceive them; where there are thousands there will be severe pain in the muscles, stiffness, weakness, hoarseness, fever, &c.

This worm bears no particular resemblance to any other species of worms, nor to maggots, which have another shape, and are larger. If a piece of flesh containing the animal in shell be carefully inspected, the ovoid opaque shell can be just perceived as a yellowish white, and granule. If one of these carefully be separated from the flesh, placed upon a slip of glass and a drop of hydrocloric acid be added the shell slowly will be dissolved and the animal become plain under a microscope of 60 degrees. The cut should be made in the diameter of the fibres and laid very straight on the side.

The preventive is well cooked pork. A trichinæ exposed to the boiling point invariably dies. A person who eats much nutritious food, and whose digestion is rapid, will pass off the trichinæ before the mother can breed her young.

Mr. Solon Robinson.—Almost thou persuadest me to be a—Jew.

Dr. J. V. C. Smith.—The best remedy for this disease is not to eat pork.

Dr. Brown.—We should consider that the hog is our best scavenger. We forget that we will be likely to avoid the disease if we give the hog heathful food.

Dr. Richards.—Repeatedly is it stated that thoroughly to cook the food is a sure remedy. The reason why this disease is not so common in this country, is because we cook our food more than is done in Germany. I consider that the thorough cooking of food, particularly meat of all kinds, is an evidence of high civilization.

A vote of thanks was presented to Dr. Brown, for his exceedingly able and instructive address.

Prof. Vanderwyde presented a photograph of the trichinæ in a beautiful frame, colored almost as perfectly as such worms appear when alive in the flesh of the pig.

Hollow Horn.

Mr. Wm. Barnes, Alden. McHenry county, Ill.: My remedy is a tablespoonful of pulverized copperas given twice a week in meal or bran ; and, if the weather is cold, a tablespoonful of spirits of

turpentine applied to the hollow of the head at the root of the horns once or twice. Keeping cattle fat is not always a preventive. I had a cow wintered over in high condition; first of June she came in, was fat, and gave a large mess of milk, and yet she had the hollow horn severely. I cured her by the above treatment in ten days.

Tape Worm.

Dr. P. J. Becker, Auburn, N. Y., April 2, 1867: Some six or eight weeks ago in reading the debates of the Farmer's Club, I came across a statement from a physician, stating that pumpkin seeds were a cure for tape-worm, and knowing that Mr. J. Elliot, a druggist in this city, had a little son afflicted with this terrible scourge (he having occasionally passed small parts of it), I sent it to him. On Saturday last (March 30), having succeeded in procuring some pumpkin seed, he peeled, mashed them into a mass of some two ounces, and gave them to his boy. After two or three hours, gave a good dose of castor oil, and in the course of five hours from the time he began taking the seeds, he discharged a complete tape-worm with head and all its parts, twelve feet in length. The boy, who is in his seventh year, has been pining away for months, and his parents had begun to despair of his living, but now hope brightens every prospect.

Adjourned.

April 16, 1867.

Mr. Nathan C. Ely in the chair; Mr. John W. Chambers, Sec'y.

Distribution of Flower Seeds.

The Secretary stated that Mr. Norman Wiard, the celebrated engineer and manufacturer of cannon, seeing the great number of letters asking for flower seeds, purchased $10 worth at a celebrated seed store, and presented them to the club for distribution.

Mrs. Susan G. Briggs, Crum Elbow, Dutchess Co., N. Y., also has sent a large quantity of flower seeds for the same purpose. They were done up in packages and beautifully labeled. Within the last five days, the secretary received 700 letters from 19 different States. These seeds generally are sent to new locations, to ornament homes which otherwise would be cheerless.

Campbell & Labaw's Truck Springs.

Mr. W. S. Carpenter, from the committee on Campbell & Labaw's Truck Springs, reported that they witnessed a practical trial of a

one-horse truck, with a load of 3,000 pounds; the springs weighed from 75 to 100 pounds, and think they could have carried 1,000 pounds more. They can be made by any blacksmith. Two bars run from the axle to the body, one is attached to a slide to which is connected a cylinder of rubber, placed horizontally under the body; the slide moves, giving a spring up and down of three inches, to one inch on the slide. The rubber is tapered; the more it is tapered the easier is the spring. For the object claimed, it seems admirably adapted. The cost is less by half of common springs. For two-horse trucks the expense is not much greater.

Secor's Hay Fork.

Mr. Chas. L. Bellamy, Hempstead, L. I., sends to the clerk one of Secor's Hay Forks. This is a new invention, made wholly of steel, without joint, brace or wooden head; the tines form a continuous circle, and it is claimed to have extra strength, and will not settle or split. Some of the members suggested slight improvements; all commended its beautiful workmanship.

Mr. W. P. Peck said this fork is objectionable in certain respects, as it is difficult to trip it under certain circumstances. Unless the tripping-cord is pulled nearly downward, the fork will not drop its load.

Vineland.

The chairman read a letter from Mr. Stephen Sewell, Scarborough, Maine, inclosing an editorial from *The Portland Transcript*, giving many alleged facts regarding Vineland, the substance of which are: That there is a secret history which, if told, would startle people; that men with limited means have been induced to buy land there, when all they were worth was swallowed up in a barren soil; that it is impossible to raise a paying crop the first year; that some of the settlers were reduced to such straits, that they were glad to sell out for just money enough to get away; and, finally, that a man with only moderate means, had better keep away from Vineland.

Dr. Peck.—People must expect hardships in a new country. How often do we see people coming back from the fertile west, too glad to get back. There are men in all places, who cannot get a living from the soil, however fertile it may be. For years Vineland has been pronounced a failure, and yet people get a good living there, build nice houses, educate their children, and enjoy refined society. There are many men in this city owning

property there, among whom is Mr. Gerow, the veteran cashier of *The Tribune*, and they have profitable and fine farms.

Dr. Snodgrass.—We all know of people coming back from new countries crying they would not have the land for a cent an acre, while others go on, and not being discouraged with slight obstacles, prospered. Those who had such bad luck at Vineland, probably went to the wrong place.

Mr. R. J. Dodge.—A man worth $1,200 need not expect to support his family on new land the first year. He must subdue the soil and apply manure. Then there is another thing. Vineland is not recommended for general farming, but especially for fruit; and to grow fruit, time is required. Under these circumstances it is not fair to condemn a country.

Dr. Jarvis.—We have a great deal of land on this coast incapable of producing crops the first year. The south shore of Long Island, and much of New Jersey, is similar; it has been overflowed by the ocean, which has left a deposit of sand, and it requires large quantities of manure to become fruitful. Then, it will cost from forty to seventy dollars an acre to get out the scrub oaks. Much labor, capital and time are required to make the radical change which the soil requires.

Mr. Chapman, Manchester, N. J.—The trouble seems to be, that men living in the city, having got a little money together, have gone to Vineland, and not understanding what it is to clear land, they hired work done and got cheated, and they have not money enough to do this and to buy manure, which is necessary to correct the poison in the soil. Lime must be applied to neutralize the poison in the soil, which is injurious to vegetation. Manure is also essential to the production of crops of any kind. When the soil there is correctly managed beautiful crops are produced. A man with limited means never should go there.

Mr. N. C. Meeker.—Last fall, the American Institute, in these rooms, awarded the highest premium to Vineland fruit. Their corn and vegetables were very fine. But there is one thing I do not understand. I am well acquainted with new land, and I understand that if good crops cannot be got the first few seasons, it is a hopeless case. Land grows poorer and poorer with each crop, and finally manure has to be used. But here, farming commences backward. The first thing after clearing land is to manure it. I am not used to this style of business. A few words regarding the remarks of Mr. Dodge. My opinion is that land

which is only good for fruit, is not worth much, because it least half of the time fruit will fail. It is like a man dying at twenty-five when he should live till fifty. There is another point. Vineland is not the only place in the world, and there are thousands of men who want to make the best use of a small capital, say $1,200. Now, there are plenty of places in the west, near railroads, or where they will come, which a man from the Eastern States can reach in a few days, and if he have five, ten or even fifteen children, and only $1,200, he can buy a farm of forty or eighty acres, with house, barn, and already fenced, and have money enough left to buy a team; and he can start a plow the next day after his arrival, and in two hours after, his children may be dropping and covering corn, which will yield from thirty to eighty bushels an acre. The land will grow other crops just as well, and do it for years.

Mr. Wm. S. Carpenter.—I cannot agree to the statement that fruit is a failure half of the time. Raspberries, blackberries and strawberries, and all the small fruit, seldom fail. But I grant that this is true regarding apples and peaches.

Now, I wish to say that I was on the committee appointed by this Institute to examine Vineland, and I opposed the report that was made, for the reason that I saw the soil was not suited for general farming purposes. Men expecting to get a living from the soil must be able to raise a variety of crops, and I don't believe that naturally grass enough will grow there to keep a cow.

Dr. J. C. V. Smith.—I have been to Vineland myself, and I was pleased far beyond my expectations. There is a most thrifty, enterprising community, and it will be difficult to find a place east or west, where such progress, in everything that makes home desirable, as I saw there. It is honorable to New Jersey, and to New York. Let us not be discouraged in this way, but redeem the land, that there may be homes for the poor of our cities, and more fruit for our people.

Mr. E. Williams.—I have refrained from speaking on this subject. I visited Vineland on the recommendation of the committee. Manure has to be brought forty miles. Last summer I saw wheat, oats and barley which were manured, and they were good; but when not manured they were not worth cutting. If there were marl handy, it would be another thing. When I went there I was astonished. They keep their cows tied up in little pens. In almost every yard a ticket was put up, "For sale." Those little

pines seem to have been growing ten thousand years. The Club ought not to induce people with limited means to go thither. Rich folks can do well enough.

Remedy for Barren Fruit Trees.

David Lowe, Norwalk, Conn., wrote to the Club that he had succeeded in rendering several of his barren trees productive by girdling the limbs, being careful not to injure the new bark. Instances are on record in which the entire bark was stripped off the body of a fruit tree, and the result was that the next season the barren tree produced a bountiful crop of fruit.

The old bark can be removed in June or July, when a new layer of wood is about to be formed, and a new and smooth bark will appear.

Cabinet Bedstead.

Judge Maine, Boston, Mass., exhibited a new cabinet bedstead. This is an ingenious bed, occupying very little space, which can be ventilated; is balanced, can be set up in any part of the room. Several members spoke of it as likely to be useful, because it is so cheap.

A Roller Whippletree.

Mr. S. Edwards Todd, exhibited a roller whippletree, for the purpose of showing how a friction roller can be attached to the end of a single whippletree, for the purpose of carrying the whippletree past a fruit-tree, when the land is being plowed near the body of the tree. A wooden roller, about five inches in diameter, and an inch or more thick, is secured to the whippletree on the upper side, and the roller extends byond the end of the whippletree, so as to encounter the tree instead of the end of the whippletree. The periphery of the roller was covered with a belt of India rubber.

Dr. Peck said no one ought to plow within four feet of fruit-trees, and that cultivation close to the trees should be by hand.

Mr. R. J. Dodge said this might do for a little garden, but for an orchard, such a notion is behind the age.

Best Time for Sowing Spring Wheat..

Mr. H. G. Neal, Davenport, Iowa.—After an experience of some 15 years in farming on the prairies of this county, I propose the

following rule as to the time for sowing spring wheat, which I am satisfied if a man follows *strictly*, he will have no cause to regret: The ground is well plowed in the fall. As soon after the 10th of March as the frost is sufficiently out and the land dry enough, sow the seed and cover well. "In the morning sow thy seed, and in the evening withhold not thy hand." I had been told by a man of large experience in wheat-raising, that two acres sowed in March, was worth three sowed in April. In the spring of 1855, I commenced the 3d of April, the top of the ground thawed barely enough to admit of harrowing, with a large snow-drift on one end of the field; had to leave about half an acre and plant in corn; sowed the first 15 acres with Red River wheat; yield 24½ bushels per acre. Next cut off the corn stalks, raked and burned them, harrowed the land, sowed broadcast, from the 10th to the 20th of April, 29¾ acres with Canada Club; yield, 30⅝ bushels per acre. In 1856, sowed from the 9th to the 16th of April; yield, 27 bushels per acre. In 1857, spring very backward; commenced harrowing for wheat April 22, in the evening, the ground too hard frozen in the morning to admit of harrowing, and six inches below the surface was still frozen hard as a rock. From the 23d of April to the 4th of May, inclusive, sowed 73 acres sod ground; yield, 22½ bushels per acre; the breaking was done lengthwise, and the sowing crosswise of the piece; the first breaking very heavy, gradually becoming shorter in the straw, and thinner on the ground, as the breaking was done later, until, on that broke last, there was not more than from one-half to two-thirds as good as on that broke earlier, but the quality was all No. 1. Finished breaking July 22. In 1858, failed to record the time of sowing, probably the fore part of April; spring very wet, sowed in the mud; 65 acres put on 120 bushels No. 1 wheat, harvested 187 bushels by measure (which weighed 45 to 50 pounds per bushel), from about one-third of the piece; concluded the balance would not pay for harvesting. In 1859, sold my farm and raised no crop. In 1860, sowed from the 15th to the 20th of March; yield, 26⅝ bushels per acre. In 1861, sowed the 12th and 13th of April; harvested a little less than 24 bushels per acre. In 1864, sowed the last week in March, and the first week in April; harvested 27 bushels per acre. Average yield for the six years named, about 22½ bushels per acre; only two years out of the six, I sowed as early as March, and I think no one will deny that the yield was a very large average one. Leaving out the

great failure of 1858, and the average would be 26 bushels per acre for five years; and three years out of the five sowed in April and May. Let the advocates of sowing Spring wheat in January and February show a better yield for five years out of eight, and then I am ready to admit that there is some defect in the rule I have laid down, and not till then.

Barn Cellars.

Mr. Alfred Ruthbun, New London, N. Y.: I am about to build a barn and am undecided whether to arrange the cellar for a cow stable, or for storing manure.

Mr. N. C. Meeker.—Cellar stables usually are dark, and are likely to breed disease. Cattle like to look out. Horses in particular are anxious to see what is going on. They will even look through cracks and knot holes, with all the curiosity of a boy. Use the cellar for manure, for hens, and the storing of farm implements. If much stock is kept, have elevated platforms or bins below, to catch the manure, whence it can be slid into a cart. We know of a small stable where all the manure falls directly into a cart below, and when loaded it is drawn to the field. To handle manure is the hardest work on a farm. Very often farming is made profitable or otherwise by considering wisely the question of saving labor.

Pruning and Cultivating Grape Vines.

Mr. Holton of Haverstraw, delivered an address on this subject, accompanied by illustrations on the black-board, which was listened to with attention.

Mr. Wm. S. Carpenter said he was much pleased with the remarks, coming as they did, from a practical and skillful grower, and he moved a vote of thanks, which was carried unanimously.

Dr. R. T. Underhill of Croton Point, made some suggestive remarks on grape culture in general. He said it was his experience that the wine of the best flavor only can be produced from a soil mostly mineral. A cold clay soil is not favorable. The dryer the soil the better, the more you force and manure the poorer will be the vine. The smaller the sap vessels of the vine the better will be the wine. Where they produce such a large number of gallons from an acre, the quality must be poor. He used to plant deep, but now he does not, and the upper roots which are of no use, are to be cut off with the cultivator and plow, for it is important that the atmosphere should have access to the troos.

Adjourned.

April 30, 1867.

Mr. Nathan C. Ely in the chair; Mr. John W. Chambers, Sec'y.

Plastic Slate.

A statement was read from Mr. Wm. L. Potter, the president of the Plastic Slate Company, that Newell's planing establishment, at the foot of Nineteenth street, this city, having a great variety of angling roofs, is covered with this material, and he invited the Club or other persons to call or examine it for themselves.

Mr. N. C. Meeker.—I understand that there are several hundred roofs in this city covered with this material; would it not be well to visit some of these also? Mr. Sinclair, Croton, N. Y., had a roof covered with it, and pulled it off. Justice to the public would seem to require that his roof should be investigated.

Dr. Peck.—Perhaps the foundations of those roofs were not firm. I think one of them was not sufficiently rigid, and hence the felt cracked. One cannot expect satisfaction where work is done imperfectly.

Mr. Horace Greeley.—When statements are made about the failure of plastic slate, I wish they would state the true reasons for their failure. I have been rather in favor of it, but I think that natural slate will make the best roof.

Vineland.

Dr. Peck.—We have a gentleman here who has come from Vineland to make a plain statement about the soil; and introduced Mr. Howe.

The Chairman.—The charge against Vineland, as it was before the Club two weeks ago, was not that good crops could not be produced there, but that men going thither with small means, ($1,200 was mentioned) would be likely to starve, because they could not raise a crop the first year, and before they could raise anything their money would be gone.

Mr. Howe.—I went to Vineland from New Hampshire. I cleared four and a half acres, planted it to potatoes, and raised from 100 to 150 bushels to the acre, which I sold for $1 a bushel; I used two or three hundred pounds of phosphates to the acre; it cost $40 to $50 an acre to clear this land. I have sold that place and bought again; it was three-fourths of a mile from the station, and I got over $7,000. There were twelve and a half acres, and it cost $25 an acre. The crop I spoke of I raised the first year. For

manure we have plenty of muck, which belongs to Mr. Landis; we get it free. We haul from a few rods to three miles; marl costs $1.80 a ton; shell lime 14½ cents a bushel, and stone lime 29 cents. Ten tons of marl to an acre, once in five years, will bring good crops. I have not had much experience in grass. I raise oats to feed green to my cow and horse. Grass is not natural to the soil—does not grow unless sowed. A man who has lived there eighteen years raised two tons and a half to the acre; a part of it was weighed, the rest guessed at. He raises twenty bushels of wheat and sixty bushels of corn to the acre. I have now 16½ acres, but expect I have sold ten acres. The people who left did not like to work before they came, and they did not like it any better there. I have refused $7,000 for six acres; of course I have fair improvements.

Mr. Quin.—You seem to be getting rich by selling places at high prices. I want to know if people get forehanded by sticking to work, the same as they do off west.

Mr. Howe.—Yes. I know of no other locality I like so well; no people are more enterprising or intelligent. I do not wish to go back to New Hampshire. I have worked among the rocks there long enough.

Mr. Horace Greeley.—I went to Vineland and came back at my own expense. I wanted to see for myself, and I looked it over carefully. I found the soil better than the average of Long Island land. It has more clay in it than the average of land of the ocean deposit. It is easily cultivated. They have a most refined, intelligent, and temperate people. They have a great advantage in agreeing not to build fences. The way in which my speech was reported on Vineland was not to my mind. We may grant that what has been said here is all true, but any acre of that land requires forty tons of marl, and to this should be added $100 worth of other manures. This was the statement I made, and I was reported as saying little manure is required. Then I would plow deep, two feet if possible, and plant to strawberries, raspberries, and other small fruits, and the land will be worth $300 an acre. My general complaint is that they convey the idea that only a little manure is required. It is true that by this process something may be raised, but in a few years the soil will be exhausted. Let us meet this case—let them meet it in a proper way—that is, adopt a system of high cultivation. If they do it they will succeed. Now, I would like to hear from Mr. Quinn, who is a better farmer than I am.

Mr. P. T. Quinn.—I went to Vineland to satisfy myself of the value of a million and a half acres of New Jersey land. I agree with Mr. Greeley, that they greatly need manure. It is not a question of Vineland, or any other particular locality. My opinion is that if they undertake to get along without a liberal use of manure, farming there will be like throwing chaff against the wind. I like their spirit, their customs, and their frequent meetings together. I was surprised at the fine growth which pear and apple trees made, for they require high cultivation; but I hesitate to decide on the vitality of their trees, or how they will turn out, till a few years shall pass, for I have seen most promising young orchards speedily decay. By a judicious outlay of capital, and by skillful industry, they can become independent with less muscle than on hard clay land.

Mr. Gerow.—I consider myself as a sort of patriarch in Vineland, as some of my family have been there from the first, and I was there eight months in 1863, and about nine months in 1864. I have never attempted to deceive. When people asked me if we could raise good crops the first year without manure, I answered yes or no, as I believed of the particular crops inquired about. The soil has some peculiarities, for cabbage and Lima beans grow well on new land, and yet bush beans will not produce the seed without manure. As to grass, people have not been there long enough to decide this question, but I have noticed clover growing by the side of the road, where seed had fallen from loads of hay, and it grew as large as the stalks of buckwheat. The people do not have large incomes, because they are constantly investing what they earn in improvements. Property all the while is rising, plenty of places are for sale, because people want to buy. The town is so handsome, and so regularly laid out, and schools and society are so valued, that a little place near the station will sell for a high price.

Dr. Trimble.—I came from Vineland yesterday. I am deeply interested in seeing these millions of acres of Jersey land improved. The people are highly intelligent. It was encouraging to see the large quantities of manure they are bringing in this spring.

Prof. Tillman.—I have just returned from Ocean county and Tom's river. I find many localities much nearer this city than Vineland, which are worthy the attention of those seeking country homes. The soil is well adapted for small fruits. I venture the prophecy that twenty years hence the now barren wastes between

Raritan and Delaware bays, will have become one continuous garden.

Nitre in Manure.

Among the numerous questions for discussion were the following: Does the farmer's manure heap ever become a nitre bed? Can it be made to become so cheaply? Dr. Vander Weyde replied that most of the fertilizers are a combination of a base with some kind of acid. All that a farmer has to do is to put wood ashes on his compost heap to form nitre. The nitrogen in the manure heap combines with oxygen to form nitric acid. Potash, he said, is one of the strongest bases. In Germany and Belgium farmers mingle their wood ashes with their barnyard manure, and of this they form nitre. No trees can grow when there is not a good supply of potash in the soil. Ashes applied directly to the soil are too strong as a fertilizer. They want an acid with the base, or potash in the ashes.

Rev. Mr. Bolton of Livingston county, New York, stated that he had been accustomed to sow ten bushels of unleached wood ashes per acre, on his meadows. On the same grass land, he sowed also one bushel of gypsum. These articles were sowed early in the spring of the year; and he thought he doubled his grass crop by the fertilizers thus applied. In his section of the country, wheat is grown more extensively than grass. He stated that one of his neighbors had produced fifty-nine bushels of wheat per acre, by dressing the land with a compost of three bushels of wood ashes and one bushel of gypsum, and one of salt, sowed broadcast.

Empire Wind Mill.

The superintendent of the Empire Wind Mill Co., explained the merits of this mill, which stood on the platform, and made quite a display. It is six feet in diameter, is so constructed as to adjust and regulate itself, and will run a two-inch pump. Six sizes are made, which cost from $60 to $1,200 each. Those costing from $150 to $300, will cut fodder, winnow, churn, turn a grindstone, and run a small pair of stones for grinding. The higher priced ones grind, saw wood, and are most useful for pumping water for stock and domestic use, and for railways and draining land. One of the largest size has been in use at Southold, Long Island, for ten years, and a report of how it is doing was promised for the next meeting of the club.

The chair thought the subject of wind power very important,

and declared the sense of the meeting that the club was entertained by the working model before them.

Dr. Peck mentioned a place near the city where a windmill pumps water for the house and barn from a spring a hundred feet below in a valley, g ving complete satisfaction.

How to Shoe a Vicious Horse.

Mr. F. Taylor, Indianapolis, Ind.—Hitch your horse to a secure post with a noose rope halter, sufficiently strong to be in no danger of breaking. Take another strong rope, say twenty-five feet long, make a running noose upon one end of it, throw this noose upon the ground near his hind feet, and gently move him until he steps in the noose; pull your rope and tighten it around his leg well down towards the foot; if this should be the near hind foot, you then pass the end of the rope across his back to the off side, bringing it back again under his neck across his breast, and then on the near side of the horse two stout men take hold of the rope and pull. They should pull gently but firmly, holding his foot close up against his side. A third person stands by his head and soothes him. Everything should be done kindly and gently, however much he may struggle. After he has given up, the smith may go forward of the foot and commence work upon it. The men at the rope may ease up just enough to give an opportunity to do so. I have rarely seen a horse make more than one or two efforts to relieve himself after the smith commences. In shoeing a horse in this way there is no great amount of muscular power required, and with ordinary care there is no danger in it, either to the parties performing the operation or to the horse.

How to Can Fruit.

Mrs. A. E. Powers, Scriba, Oswego county, N. Y., sends us the method adopted by her in canning fruit. I will suppose your fruit and glass cans are all ready. I prefer cans with glass covers. I scald the fruit in a large tin pan, with juice or water to cover it. Put half a teacup of cold water into every can, and fill up with hot water; put the covers and rubbers also into hot water. Now empty a can and fill full with the hot fruit, and then another. Let them stand open till the hand can be held upon them without burning. As soon as filled, cut writing papers the size of the can, one for each, and when cool slip one over the fruit entirely, and

fill up the can on top of the paper with boiling juice, and seal at once. Ladies, try this way; the fruit will never mold, and will keep any time, if you don't eat it. The papers keep the fruit from rising to the top of the liquid. There is no use of setting cans into water to heat them, or of putting them into quilted bags; it is too troublesome. I let the fruit shrink, and then fill up to the cover as close as possible. Ladies must be governed by their own common sense.

Adjourned.

PROCEEDINGS OF THE POLYTECHNIC ASSOCIATION.

AN ORGANIZATION UNDER THE CONTROL OF THE AMERICAN INSTITUTE.

American Institute Polytechnic Association,
May 10, 1866.

Professor S. D. Tillman in the chair; T. D. Stetson, Secretary.

New Chemical Symbols.

The chairman opened the meeting by saying, I now present in connection with my new chemical nomenclature submitted at the last meeting, a new series of symbols intended to facilitate the acquisition of chemical knowledge.

The subject is too vast and complex to be embraced in a single lecture. I shall, therefore, only aim to indicate the leading features of the plan, and to present such rudiments of chemistry as relate more particularly to those elementary substances which are not regarded as metals.

All matter may be first classed as ponderable and imponderable. The latter I have discussed very fully before the Polytechnic Association at previous meetings.

Chemists now recognize at least 64 different kinds of ponderable matter which have not thus far been decomposed, and are, therefore, regarded as simple bodies. Fifty-one of these are called metals and 13 non-metallic elements. French chemists do not draw the line of distinction so broadly, since several of the non-metallics possess nearly all the characteristics of the metals. They recognize 49 of the elements as metals and designate the remaining 15 as metalloids. The objection to this classification is, it assumes that all elements which are not metals are *like* metals. Seven of these metalloids are strongly electro-negative, and in their general behavior bear no resemblance to metals. On examining the non-metallic elements it will be found most convenient to classify them according to the state or condition which they assume when isolated. Three elements are remarkable for their hardness or impenetrability, namely:

Carbon, Boron, and Silicon.

They are denoted by a pyramid in the center of the first diagram (fig. 1).* The three boundaries of one face of a pyramid will respectively represent these three elements.

Silicon or *Silicium* fuses at about 1450 degrees Centigrade—the melting point of steel. *Boron* is reduced only at a still higher heat. *Carbon* when perfectly isolated and surrounded by substances with which it has no affinity, remains solid and infusible under the highest heat thus far applied.

As the antipodes of these hard elements we have three gases which under the lowest temperature and highest pressure yet applied to them, have not been reduced to the solid or even to the liquid state.

They are *oxygen*, *nitrogen*, and *hydrogen*.

The three lines in figure 1, fartherest from the centre, represent these attenuated elements. To the class of gases also belong *fluorine* and *chlorine*, which are represented by the lower lines in figure 2. Thus the five gases are designated by the five boundary lines of that diagram. Fluorine is the only element which has not been obtained in a separate state; but considerations which need not here be given, justify the assumption that fluorine, when isolated, is a colorless gas.

Chlorine is a transparent greenish-yellow gas at ordinary temperatures. When subjected to a pressure of about sixty pounds to the square inch, it becomes a yellow liquid; yet when cooled to 140 degrees Centigrade it still remains unfrozen.

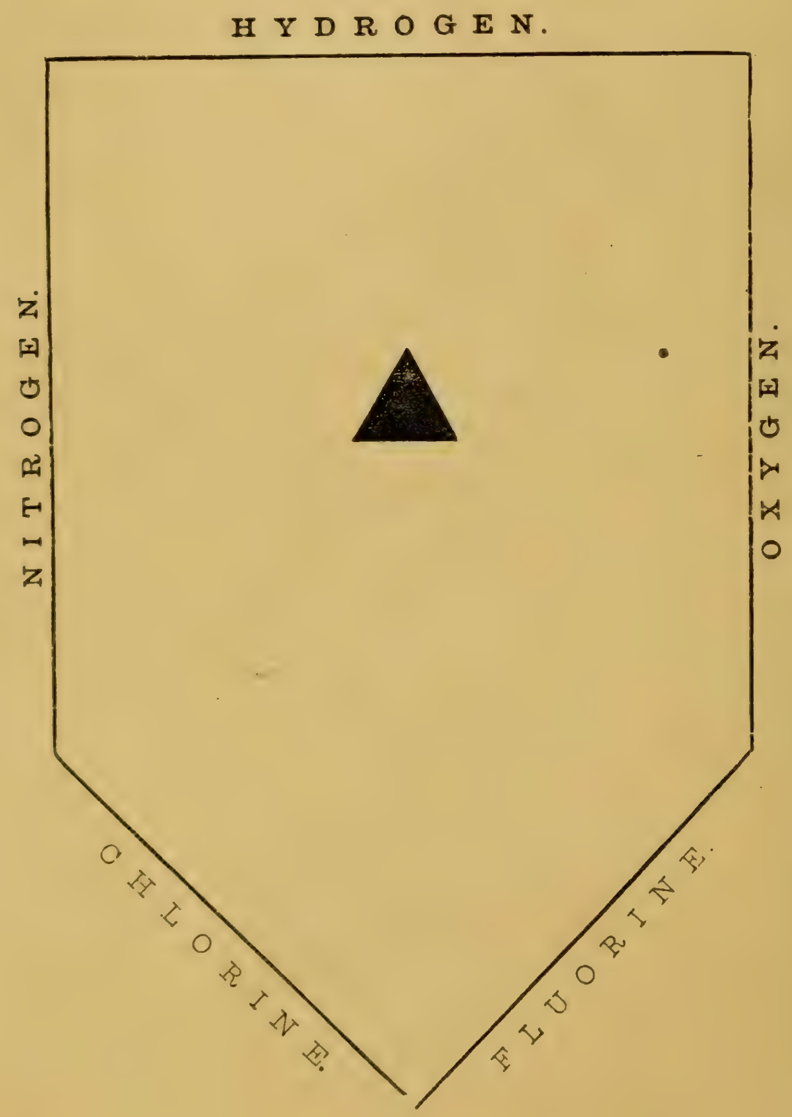
Between the three hard elements and the five gases, are found five non-metallic elements, which readily pass from the solid to the gaseous state on being heated, viz., bromine, iodine, sulphur, selenium and phosphorus. If the French view is adopted we must include as metalloids, arsenic and tellurium. These *seven* elements are shown in figure 3, which is so arranged as to represent the solid state of the element by a thick line nearest the center; then the liquid, and lastly the gaseous state near the outside of the diagram. It will be observed that bromine is not represented by a thick line because at ordinary temperature it is a liquid. Bromine becomes a solid at 12°5C. and boils at 63°C.

* The figures and symbols illustrating this article have been entered according to Act of Congress, in the year 1867, by S. D. Tillman, in the Clerk's office of the District Court of the United States for the Southern District of New York.

Figure 1.

Three Permanent Gasses,	HYDROGEN, NITROGEN. OXYGEN.
Three Hard Solids,	BORON. CARBON. SILICON.

Figure 2.



The Five Gaseous Elements.

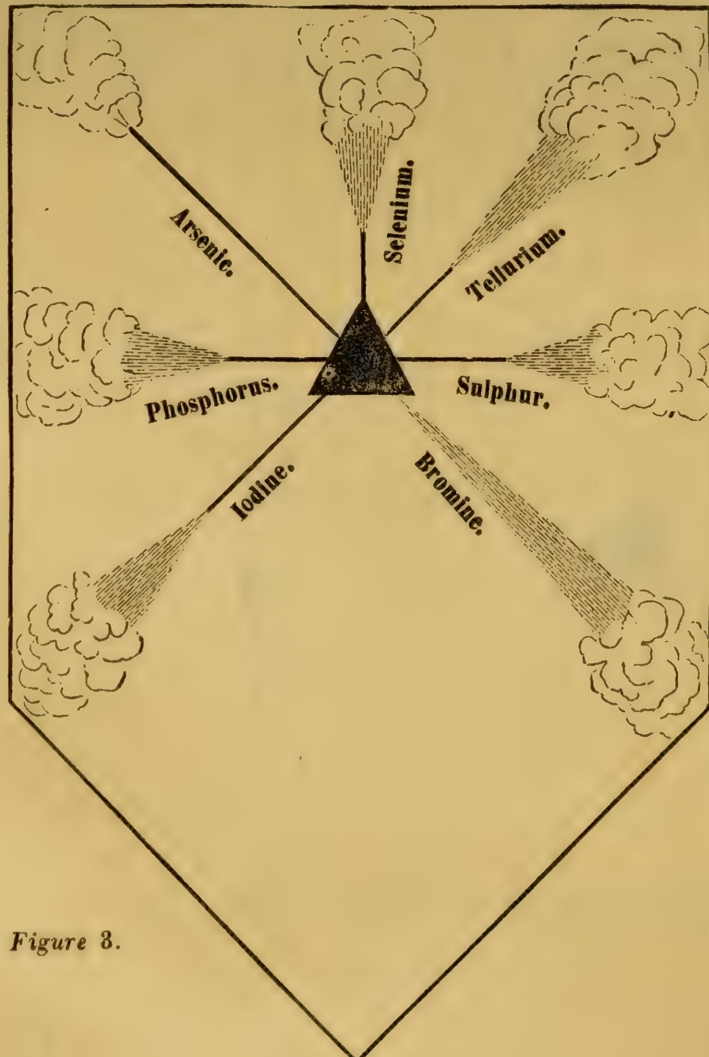


Figure 3.

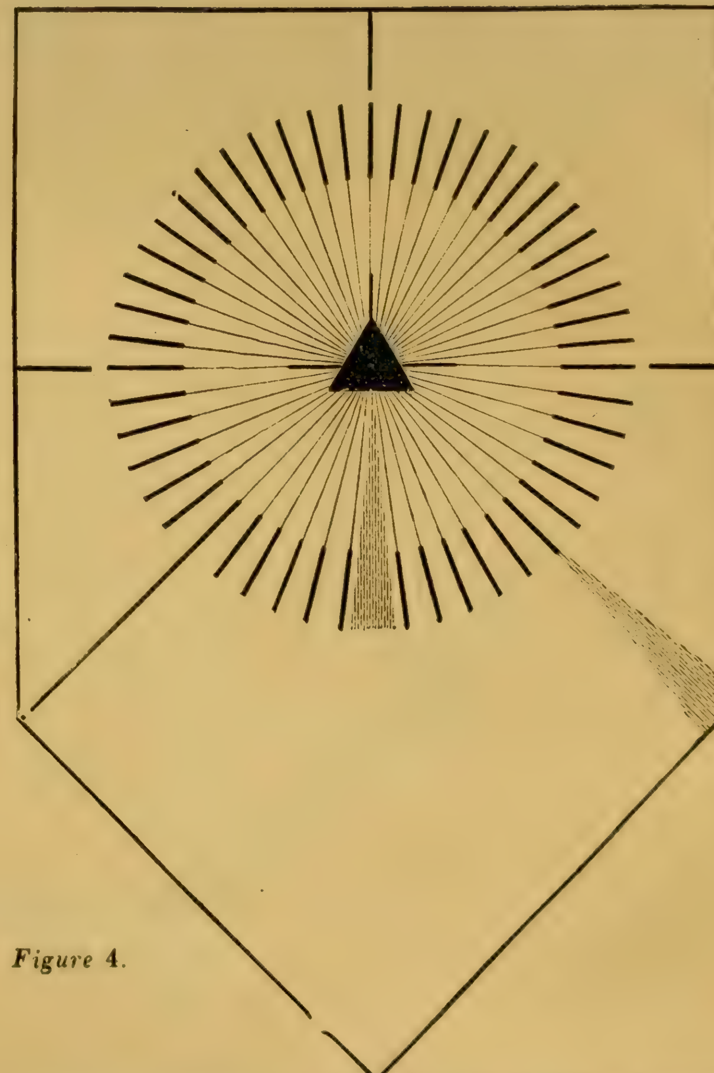


Figure 4.

Iodine melts at 107°C. and changes into a splendid blue vapor at 175° C.

Sulphur melts at 115° C., and becomes a deep yellow vapor at 440° C. Sulphur has several modifications of form, or different allotropic states, in which it is differently affected by heat.

Selenium melts at a little over 100° C. In the crystalline form it softens at 217° C., and does not become completely fluid until above 250° C. Heated in a close vessel it boils at a little above a red heat.

Tellurium, which has the appearance of a metal, fuses a little below 480° C., and at a high temperature becomes a vapor.

Arsenic is not known in a liquid state. At 180° C. it begins to volatilize, without fusing. This peculiarity is represented by a thick line extending from the centre to the point where it is shown as a vapor. This element, as well as tellurium, I prefer to class among the metals.

Phosphorus melts at 45°, and boils at about 229° C.

The metals are solid at ordinary temperatures, with the exception of Mercury, a fluid which freezes at 39° C., and becomes a colorless vapor at about 360° C. A large majority of the metals melt at a high temperature; yet several of the light metals of the alkaline class become fluids below the boiling point of water.

The fifty-one metals, including arsenic and tellurium, are represented by the radial lines in figure 4; the shaded line projecting directly downward denotes the fluid, mercury. This diagram includes *all the known elements*, arranged so as to show with clearness their classification as fifty-one metals, and thirteen non-metallic bodies; also their actual state at ordinary temperatures, embracing

Gases	5
Liquids	2
Solids	57
Total	64

The density of the gaseous elements is represented by fig. 5. Hydrogen the lightest, being at the top; fluorine and chlorine, the heaviest two at the bottom; oxygen and nitrogen having an intermediate position on the sides. The equal parallelograms projecting from the sides, represent equal measures or volumes of gas at the same temperature and pressure, and the wide mark or bar within each parallelogram shows their relative density or specific gravity. Assuming that one volume of hydrogen weighs 1, one

volume of nitrogen will weigh 14; one of oxygen 16; one of fluorine 19; one of chlorine 35.5. As these gases unite in equal volumes or multiples of equal volumes in forming chemical compounds, the smallest portion which can enter into combination may be distinguished as an atom, therefore the bars designating the density of the gases, may be taken as the relative weight of atoms which are supposed to be of equal size. The conception of an atom must not be limited by size and weight. It is in fact the source of force. Several years ago I advanced the hypothesis that the ultimate atom is a hollow sphere containing and surrounded by the imponderable ethereal element, and incessantly moving to and from its own center. Whatever may be its condition in chemical combination, it assumes its original form and motion on being released and isolated.

The arrangement of the elementary gases in figs. 2, 3, and 4, has another important signification. Oxygen unites with all other elements except fluorine and is electro-negative. From the position of oxygen passing around the diagram downward and then upward, we find these gases in the order they are found in electrolysis. Hydrogen being to the other four, electro-positive. The gases and other non-metallic elements are arranged so that elements belonging to the same family are found in close proximity, and thus their atom-holding power or atomicity in chemical combination may be clearly understood.

Hydrogen, fluorine, chlorine, bromine, and iodine have the lowest atom-holding power; they are monatomic, or monads. Oxygen, sulphur, selenium, (also tellurium,) are diatomic, or dyads. Nitrogen, phosphorus, boron, (also arsenic,) are triatomic, or triads. Carbon and silicon are tetratomic, or tetrads.

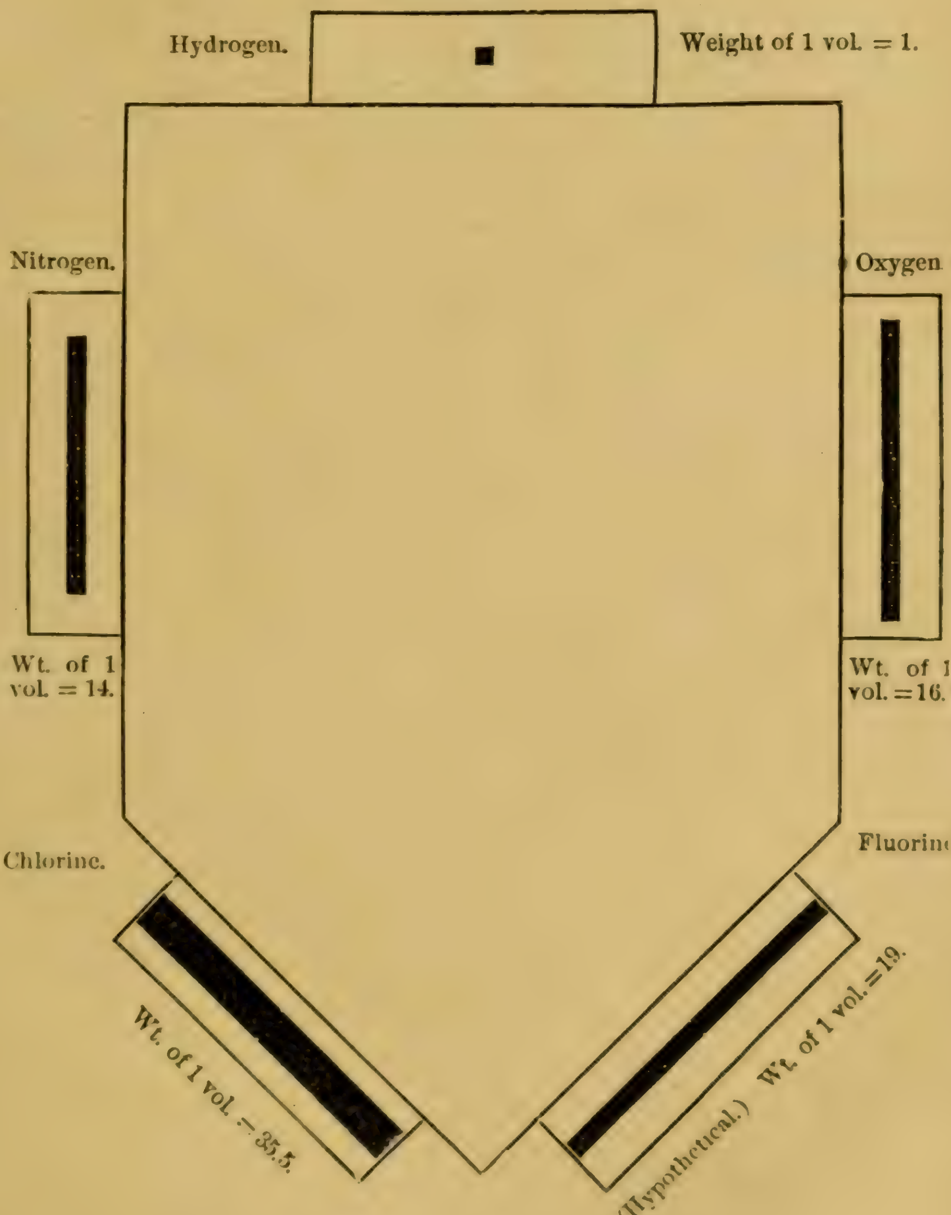
The chemical combination of two gaseous elements and their resulting volume, are illustrated by a series of diagrams. It is supposed that not less than two volumes of each element enter in combination, but the process is rendered more intelligible by representing the union of single volumes.

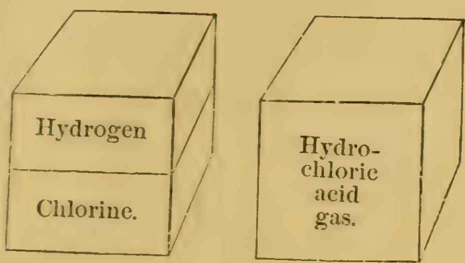
Figure 6 shows a volume of hydrogen and one of chlorine, which, under the influence of light, combine without condensation, forming two volumes of hydrochloric acid gas. Although the resulting product of the union of these gases is not diminished in bulk, yet at the instant each electro-positive atom seeks an electro-negative one there is an expansion; this process of mating produces explosion.

Fig. 7 represents two volumes of hydrogen and one of oxygen

Comparative Weights of Gaseous Elements.

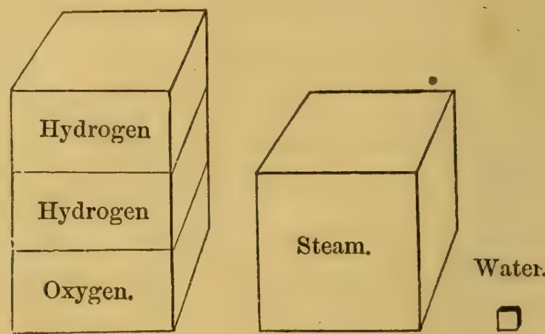
Figure 5.





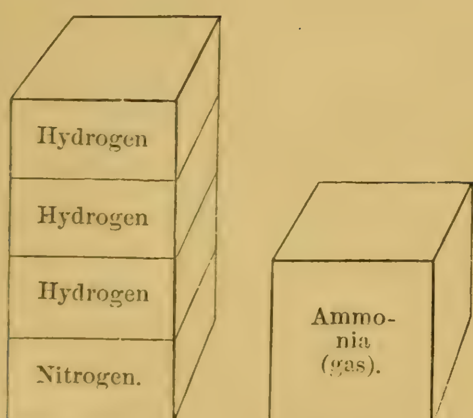
2 vol's. 2 vol's.

Figure 6.



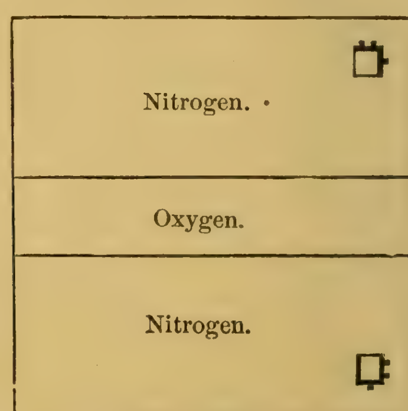
3 vol's. 2 vol's.

Figure 7.



4 vol's. 2 vol's.

Figure 8.



Common air.

Figure 9.

ERRATA.—Page 426, in 15th line, for "fartherest," read "furthest." Page 428, in 9th line, for "the source," read "a source"; on 32d line, for "volumes," read "atoms." Page 430, in 5th line, read "The four thick lines——represent"; in 12th line, read after "oxygenated water," $H_2\ O_2$——*elt.* Page 431, in line 11, the words "common air" are erroneously repeated.

entering into combination, and forming steam, which is condensed to two volumes, or to two-thirds of the original bulk of these gases in a separate state. Below 100° C. the steam is condensed to nearly one-seventeenth hundredth of its volume, forming water. As one cubic foot contains 1728 cubic inches, we may say that two cubic feet of hydrogen and one cubic foot of oxygen combine and form two cubic feet of steam, which may be condensed to about two cubic inches of water.

Fig. 8 represents three volumes of hydrogen combining with one of nitrogen, and forming two volumes of ammoniacal gas or ammonia. Thus four volumes are condensed to two, the resulting product being one-half of the bulk of the uncombined gases. To express this chemical union of atoms it would be most proper to say three atoms of hydrogen and one atom of nitrogen combine and form an *atomoid* of ammonia.

By using portions of the principal diagram on a much reduced scale, many of the most important chemical combinations of the non-metallic elements may be represented, and to each may be added the name designating its ultimate constituents, according to the new chemical nomenclature.*

Fluorine, chlorine, bromine, and iodine, forming the family of halogens, are represented by figure . One atom of fluorine being *af*; one of chlorine, *ad;* one of bromine, *ab;* one of iodine, *av;* one of hydrogen, *al;* and the prefix *g* denoting the gaseous state, I designate the acids formed by the combination of the halogens severally with hydrogen, as follow:

Hydrofluoric acid, HF,  *alaf*, at 16° *galaf*.

Hydrochloric acid gas, HCl,  *galad*.

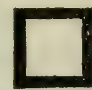
Hydrobromic acid gas, HBr,  *galab*.

Hydriodic acid gas, HI,  *galav*.

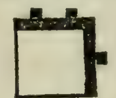
Carbon combines in such a variety of proportions with hydrogen, nitrogen and oxygen, and in many instances assuming with

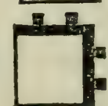
* Transactions of American Institute for 1865–6, pp. 673–692.

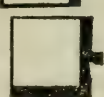
them the gaseous state, I represent it by a horizontal line connecting the lower ends of the lines, denoting nitrogen and oxygen in fig. 1, and contracting the whole, an atom of carbon is shown by the following symbol .

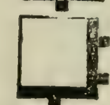
The fourth ick sides of this figure, thus,  represents the four grand organic elements. Projections from each side will denote the number of atoms of each element in a symbolized chemical body.

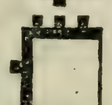
The following symbols represent some of the most important compounds of the non-metallic class:

Water H_2O  *elat*, as steam *gelat.*

Oxygenated water H_2O  *elat.*

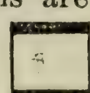
Carbonic oxide gas **CO**  *gart.*

Carbonic acid gas CO_2  *garet.*

Ammonia H_3N  *gilan.*

Nitric acid HNO_3  *alanit.*

Prussic acid, HCN  *alarn.*

The large class of hydrocarbons are represented by various projections in the following figure  for instance,

Marsh gas, or light carburetted hydrogen, CH_4  *garol.*

Similar contractions are applied to that portion of the main diagram representing all the metals, thus .

The five metals of the alkalies, lithium, sodium, potassium, rubidium, and cœsium, are symbolized by a star, having five points. 

The four metals of the alkaline earths, barium, strontium, calcium, and magnesium, by a star having four points. 

The consideration of metals and metallic compounds would open too wide a field for the present discussion.

Having spoken of true chemical combinations, and symbolized water and carbonic acid, we are prepared to speak of the mixture of gases by virtue of the law of diffusion. Figure 9 will convey some idea of the proportion of gases found in common air, nearly four-fifths being nitrogen, and one fifth oxygen. There is a trace of ammonia, carburetted hydrogen, and nitric acid in air which is not represented. 10,000 parts of common air common air contain from three to six parts of carbonic acid. The proportion of water varies with the temperature of the air. Every 15° C. of additional heat doubles the capacity of a given quantity of air for holding vapor.

The symbols now presented are intended to impress upon the mind the leading characteristics of the non-metallic elements, and by proper grouping to show their relation. This ground-work thoroughly mastered will enable the student to erect in his own mind a permanent superstructure. Thus prepared, he will quickly catch the significance of every chemical structure, and readily apply the fundamental principles of the science to the experimental work of the laboratory.

An interesting discussion followed this explanation of new symbols by Professor Tillman, in the course of which the chemists present expressed their hearty commendation of the scheme.

Improved Stoves.

Mr. J. C. Cochrane, exhibited a model of his improved stove which he claimed to possess all the requirements for perfect combustion. In ordinary stoves, much of the fuel goes up the chimney unconsumed. To remedy this, air is admitted just behind the fire, but in this process the temperature of the draft is lowered; now it is claimed that if air is applied on the flame, the temperature is increased, and if an obstruction is placed against the flame the temperature is raised. This stove is constructed on the principal of the Davy Safety Lamp. The flame is arrested by a wire guaze through which the air will pass, though the flame will not, whereby the temperature is elevated and not depressed; and all the combustible gases are consumed, the carbonic oxide gas which is so prolific in causing smoke alone escaping. This gas passes

off freely through the gauze, and is burnt on the other side. One third more heat is secured by this process than by any other. The wire cloth used here is No. 11. The fire-box is about two-thirds of the way down, and just behind the grate are passages for air which passed through a cylinder that has a partition. There is an upper draft on the flame. The stove can be seen at No. 11 Chamber street.

Mr. Frank Dibbin thought the use of fire-brick would answer the same purpose as the wire gauze, if not a better.

Mr. J. Hirsh did not see how a stove could give out any heat, the fire of which would not burn the wire gauze placed within two inches of the flame.

Mr. J. Wyatt Reid said that some years ago he drilled holes in the fire doors of boilers, which made the combustion much better. He noticed that before doing this the top of the fire was a cherry red, and when the holes were made a blue flame appeared, showing that more oxygen was admitted.

Dr. Rowell remarked that a series of experiments were much wanted in regard to combustion. There have not been any experiments made in regard to heating certain spaces. The house he lived in and one around the corner, were the same in size and built alike in every respect, yet he burned but five tons of coal during the winter, while his neighbor burned twenty, having just the same spaces to heat.

Mr. S. H. Maynard said there would be a portion of water formed by the combustion of the gases in this stove; if there was an ordinary draft it would be carried up the chimney, but if not it would be deposited on the metal, which must soon be consumed.

Rock Drilling Machine.

Mr. Walter Hyde exhibited a model of his rock drilling machine. The main novelty in this machine is the suspending of the drill from a rope, which causes the drill to turn at every blow, thus enabling him to use a drill only thirty feet long for any depth of boring He had drilled 1900 feet; much of it through lime rock, and could do the same through quartz rock. When a drill is thirty feet long, it will cut just as well as if eighty feet in length, for when it is of great length the weight of the drill can hardly come upon the rock before it is raised up. For a four inch hole the drill will weigh about 400 pounds. His oil-well boring machine complete, is sold at 1,000 dollars.

Roofing Material.

The discussion of this subject was opened by the Chairman. He alluded to the importance of the subject, and the meagre information in relation to it to be found in the books on building materials.

Dr. D. D. Parmelee remarked that much of the difficulty in obtaining a permanent roofing material lay in the fact that what would answer in one locality would not in another. A tin roof that might suit this locality could not be used in Boston.

Mr. Robinson exhibited specimens of his roofing cloth. He said it was made of calendered paper saturated with coal tar. On one sheet of paper is spread a layer of bituminous composition after which the sheet is compressed between two calender rollers by which the composition is made to adhere firmly to the paper. Then again another sheet of paper and a layer of the composition, and passed through the rollers which holds the fabric together and makes one solid sheet. The number of sheets of paper varies according to the quality of the roofing. The composition is protected from atmospheric influence by the felt which is laid on the top. The composition protects the fabric and the fabric protects the composition. The paper felt costs about six cents a pound. There are objections to all kinds of woven fabric in roofing material, as their woven texture will be worn through; but felt is not acted on in this way. The stock that this felt is made of is from the waste of the mills, old ropes, &c.; sometimes woolen rags are used in small quantities, which serve only to make the fabric a little more open. The best composition for roofing is worthy of much consideration. There have been over two acres of this roofing put on buildings in Kansas within the last two months. He claimed that his method was the best form of putting the roofing together. At about 150 degrees the tar between the layers would become soft at the edges, but not sufficient to make it run. This style of roofing has been made by machinery for two years. He had seen pieces of red hot coals thrown on this roofing, but they failed to ignite it. It seems to be as good a protection against fire as any ordinary roofing except tin or slate. The rolls used for uniting the sheets are twenty-two inches wide and fifty feet long. All his experiments with woven fabrics have been failures.

Adjourned.

AMERICAN INSTITUTE POLYTECHNIC ASSOCIATION,
May 17, 1866.

Prof. Samuel D. Tillman in the chair; T. D. Stetson, Secretary.

BALANCED STEAM VALVE.

Dr. Warren Rowell exhibited his balanced steam valve. It was made to be placed on the steam pipe, and there act as a cut-off. But it was found that cutting-off there does not possess any advantage, so this is not of much practical use, but it is here shown as a true balanced valve; as at a pressure of 100 pounds a finger can move it, being balanced in all directions.

Prof. R. P. Stevens then took the floor, and spoke as follows

ON DENUDATION AND TRANSPORTATION IN SURFACE GEOLOGY.

When one passes the disturbed portion of the Atlantic slope, crossing the mountains, and traversing the valleys, and reaches the undisturbed portion of the interior of the continent, and there finds valleys fronted by moderate hills, having in general smooth and rounded outlines, he is naturally led to compare the one with the other—to note their points of difference, or unison—to mark their phenomena, and inquire if the laws of disturbance are sufficient to explain the phenomena, of the one, and not of the other, and if so what other agency must one call to his aid, to relieve the difficulty?

H. D. Rogers, and his disciple J. P. Lesly, have written very learnedly upon the valleys of the Appalachian system, or the disturbed portion, and have called to their aid, upthrows and downthrows, faults, fractures, synclinals and anticlinals, and all the mathematical nomenclature, pertaining to phenomena, which are *liable* to have the rigid laws of this science applied rigidly to them. But these fail west of the mountains; we cannot lean upon them; they serve us not.

The most prominent topographico-geological feature of the interior, is that of our great lakes. Are they valleys of subsidence, or denudations? They are all of them very deep, save St. Clair and Erie, three of them descend to, and beneath the level of the sea. Associated with these valleys are those of New York State, lying meridionally to the axis of Ontario. Some of these valleys are partly filled with water, and partly with drift and alluvium, as Geneseo and Cayuga; others, as Otisco, have bold shores, without alluvium, or drift; others, as the Genesee, Irondequoit and Conewango, are filled with earth material, and have only insignificant streams winding through them.

As was previously said, they mostly lie in a north and south direction. Some of them begin in the middle of the silurian and are continued through the upper silurian, the whole of the devonian, and the lower coal series, and are connected with the valleys which terminate in the Atlantic. Most of them terminate in the devonian. Cayuga and Seneca cut through the flinty limestone of the Onondaga group, and the harder sandstone which lies below, while the Owasco reposes entirely within the soft shales of the lower devonian; Ontario is scooped out of the lower silurian, Erie out of the upper silurian and lower devonian; Huron and Michigan through the lower devonian, into the lower silurian, while Superior is geologically lower, cutting through the lower silurian, taconic and huronian, if this is not the equivalent of the former, and into the laurentian; Chautauque, rarest of all, reposes entirely within the upper devonian.

Are these valleys of subsidence? I answer, no. Why? Because in their neighborhood, no signs of fault, fracture, downthrow, synclinal, or anticlinal, can be found, with the single exception of Superior. Here, there are abundant signs of Plutonic agency, and which may, and probably has materially altered its profound bottom. What other agent is competent to such mighty work? Denudation with removal of detritus. What was the power, what the tools, in the hand of this agent ? Prof. Forbes and other glacialists answer, GLACIERS.

There is another system of valleys seldom noticed, because now filled with drift, peat, marls, and dense growth of swamp trees. I allude to a deep valley in New York State, which, beginning near Rome, extends with the Erie canal, to or beyond Lyons, in Wayne county.

Oneida lake, Salt lake and Cross lake, lie within this valley. Beneath the bed of the canal, in Onondaga county, it is over one hundred feet deep. The red shales of the salt group bound it on the south ; and it appears to be mainly scooped out of this group.

I am not aware of any similar valley in any other State.

The next system of valleys to which I draw attention, is that of our river systems. The Ohio will illustrate the phenomena of all the others.

Standing at its head springs, in the county of Potter, Pa., from the same plateau of Devonian strata, the Allegany, Genesee and Susquehanna issue as springs. The plateau is speedily cut down,

200, 300, to 600 feet deep. In the short distance of thirty miles from the source of the Alleghany, it flows through a valley half to three-quarters of a mile in width, and from seventy-five to one hundred feet deeper than the meadows. This is in the soft shales of the Chemung. In the harder strata of the carboniferous, the valley is much narrower. After emerging from the carboniferous, at Portsmouth, Ohio, the Ohio river begins to widen its valley—until before debouching into the Mississippi, it is from five to eleven miles wide. Its greatest depth, at any point I am acquainted with, is at the mouth of Yellow creek, where it makes its great northwestern bend. It is here 750 to 800 feet deep to the water, and about 100 feet deeper beneath. All lateral streams flowing into it have a corresponding depth and breadth. The Muskingum is, I judge, somewhat broader, in correspondence with the magnitude of the stream.

The Delaware river has a much narrower valley, and also the Lehigh; but the Susquehanna attains a corresponding breadth with the Ohio. The Mississippi is the broadest of all—twenty miles is not uncommon for it; and Harper puts it at 100 in some places of the lower portion.

Take the entire area of any given portion of the carboniferous, devonian, and upper silurian strata, drained by any of our large streams, west of the mountains, and I judge that full nine-tenths of the upper portion has been swept away along their valleys. There is another system of denudation which seems to have affected the entire surface of the country, the mountain tops, the hill slopes, the anti-clinal folds and the level champaign country. No portion of our country, which I have visited, appears to have been exempt from this erosion. Virginia and Kentucky have suffered, as well as New York, Maine and Canada.

Examples of this denudation can best be seen travelling southwards from Lake Ontario. From this body of water the traveler ascends by a series of terraces to plateaus succeeding each other, until he attains the height of the Catskill mountains. Sometimes these terraces rise boldly, 90 or 100 feet—sheer precipices—ancient sea walls were they? By means of one of these in Onondaga, I was enabled to obtain data, for the amount of denudation the soft strata of the salt group had undergone. From six to eight miles in width could clearly be made out, and for the harder limestones of the Helderburgh group, not as much.

The want of outliers prevents that accuracy of our calculations

which we could wish. Ascending to a greater geological height—the base of the carboniferous, by means of outliers of the conglomerate, we are led to the unavoidable inference that full thirty miles of the northern edge of the coal series have been almost entirely swept away; and not only this, but full seven hundred feet in depth of the strata lying immediately beneath, over a very large portion of the country.

The most remarkable example we know of, of the effect of this species of denudation, is on the east, northeast and north aspect of the Catskill mountains, viewed at a distance from either of these directions, they appear as if upheaved; but viewed from the westward, they appear but as the termination, in very bold precipices, of the great devonian plateau, which extends from Georgia north-eastward, and terminates so abruptly a little west of the Hudson river. They are mountains, not because of upheaval, but because the basal edges of the strata composing their bulk, have been cut away upon their sides fronting the horizon, from which they appear as mountains.

By what means shall we attempt to estimate the amount of denudation their strata have suffered in the line of their strike? There are two methods—one to prolong their trend, until lines drawn according to the rate of the diminution in the thickness of the strata from the maxima to the minima, or until the lines meet in an angle. In Pennsylvania, these strata are 11,000 feet; in the Catskill, only 5,000 feet; now, following this same rate of diminution, before the strata could thin out, they would reach the Adirondacs in Essex county, north of the Mohawk; and east of the Hudson, we find outliers of the lower portion as far northeast as the center of Washington county. In Canada, the devonian is found, still farther north, as far as Collingwood bay. From these rude and immature data, we can imagine that the feather edge of the devonian once rested on the Adirondacs and the Taconic mountains.

But it is south of this devonian plateau, in Pennsylvania, Maryland and Virginia, that we are the most sure of our data. Here, the coal is present on the west, and in patches on the north, east, and in the centre of the great chasm, scooped out of the eastern and middle portions of Pennsylvania. Besides these remnants, there are numerous upthrows of silurian strata, which confirm us in our deductions. The whole thickness of the carboniferous, 3,000 feet, devonian, 7,000 feet, and upper silurian, 2,000

feet, has been carried off, and laid down elsewhere, from a large portion of this State lying east of the Alleghany mountains—and from the top of these elevations, the entire thickness of the carboniferous has been removed. The New England States have suffered equally as much. The Western States probably as much, but it is not so easily demonstrable.

East of the mountains there is another system of denudation, which has effected the upthrows of the disturbed portion of the continent, and widened and deepened, and otherwise modified its valleys. All the mountains have suffered terribly from erosion, none so lofty as to have escaped this action.

It is as apparent on the White mountains as in the Highlands. I have made some measurements in the Taconic range, and find that from the range lying between New York and Massachusetts, east of the city of Hudson, at least one thousand feet have been shaved off and removed. At this point there are strong signs of glacial action, for the northwest slope of the mountain is grooved and polished, after the manner ascribed to these ice instruments.

On the summit of the Alleghanies in Maryland, at the crossing of the Baltimore and Ohio railroad, from 700 to 1,000 feet have been removed.

In a paper read before this Society about one year ago, upon the rocks of this island, I then showed that our gneiss rocks were altered schists, that lie in folded strata, and that from the apex of the folds a thousand feet had been eroded.

The Highlands have suffered in equal if not greater proportion, and the Shawangunk has not escaped; indeed, it appears as if the whole thickness of the devonian had disappeared from their summits.

Bordering these mountains, are some of the most wonderful valleys of the continent. The Great Valley has not its equal for definiteness and continuity. It begins in Tennessee and extends under various names through the Atlantic States into Canada, and terminates on the coast of New-Foundland. In our longitude it is known as the Wallkill Valley.

Its smoothly rounded hills—its gentle slopes, its fertile fields—its well stocked pastures, and its handsome farm houses, are the praise of all who travel through it. To nearly all observers it reminds them of having once been the valley of some noble river, rivalling the Mississippi in volume. Mather supposes our own Hudson to have once flowed through it. Lying west of it is the

valley of the Roundout. This marks the line of a fractnre, which has been vastly widened by denudation. This valley extends from the Hudson through Virginia parallel to the Great Valley. Upon the supposition that the upper devonian once covered this valley, there have been removed from it, its entire length, 1,500 or 2,000 feet of strata. From some remarkable upthrows which lie within it, at least 5,000 feet have been carried away. On some other occasion, I hope to be able to present these wonderful uplifts and erosions in detail.

We have, it will be seen, valleys under two dissimilar conditions: one, where the rocks have not undergone disturbance, the other, where they have been highly changed from their original position. In both instances they have reached through every geological horizon, from laurentian to the carboniferous, and should we extend our inquiries into the mesozoic, cretaceous, and tertiary, we should find the same phenomena. Indeed the profoundest chasms of erosion, are in the cretaceous of the Colorado river.

What has been the agent or agencies which has accomplished this mighty work? To shave off thousands of feet from our mountains, to scoop out wide valleys—to excavate the whole length and breadth of the country? The great American expounder of the Swiss system, says: Glaciers, nay *one glacier*, over a mile in thickness, covering, perhaps, the entire northern portion of the North American continent. Another philosopher of the Pennsylvania school, says: Some unknown agent accomplished tne work in *one fell swoop* of its most tremendous power.

I am not prepared to assent to either of them, nor to any *one* agency. It seems to me necessary to call into our aid all the forces which now act to degrade, remove, and change the surface of the globe. Time is the great element to take into our calculations. Next, *molecular disintegration* and *decomposition* Third, abrasion and removal by aqueous action. Fourth, oscillation and change in the relative height of the land area over the oceanic.

To obtain a clear conception of how this mighty work was done, let us bear in mind that we are not gazing upon phenomena of any recent date, as compared with geological time, nor upon physical features, which were contemporaneous in the date of their history. There is order and sequence in their history. One has succeeded the other, in regular geological succession. None of our valleys, with but few exceptions, save the insignificant excavations through which our present streams flow are later than the drift period.

All of them are older, and much older; some of them go back as far in time as the upthrow of primæval rocks.

The drift mantle covers the valleys as well as the hill slopes and hill tops. It is itself composed of material supplied from previous denudation and removal—the very soil of the tertiary.

What I conceive to be the true explanation is the following: Let us travel from the Highlands to the Catskills, along the Hudson from Dunderberg to Round top, and we shall get at the order and succession of events sufficient for our theory. The Highlands were the primary uplifts. Their strata was consolidated before their fracture, hence they appeared above the Atlantic as bold, jagged peaks, much higher than at present. In the upthrow there were profound chasms and gulfs. Upon the north-east and south-east there were shore lines. Immediately upon their emergence from the waves, there commenced the process of degradation, accomplished by all and the same chemical laws and atmospheric agencies as at the present. From their ruins, the neighboring shores were built up, and their profound chasm filled; hence we have the slates, and the sandstones which are found within them; hence the taconic rocks which lie upon their flanks. Their summits were lowered, their fissures widened, and the borrowed material transported to build up the succeeding formation.

In the lapse of time, the next succeeding uplift took place, which carried the highland higher, and brought up the hills of New Marlborough, and Westchester county, northward along the Hudson; this action reached to the Wallkill, and southwards to Staten Island. This uplift was attended with fracture and contortion of the softer taconic. They also came up in serrated and jagged outlines. They underwent the same process of degradation and removal into the seas inland, to build up the silurian. With the elevation of mountains, there were corresponding valleys for drainage. Each succeeding growth of the continent had its river and lake system, as well as its shore line.

In process of time the silurian suffered an elevation, in the Shawangunk mountains, and these too had to suffer the same process to help build up the Mesosoic, which was deposited upon the shore line south of the Highlands. The southern rim of the devonian was elevated by the Shawangunk uplift, but not its interior. Each in turn has helped to form the next succeeding geologic formation, but the oldest most of all; hence our primary are our lowest mountains. The devonian help build the carboniferous; the

latter the cretaceous, and this in turn the tertiary. The whole interior of the continent has been mainly builded from the waste of older strata lying on the outer edge. Some minor uplifts of ancient rock in the interior, contributed their mite.

I consider, then, that the valleys of the disturbed portion of our country are as old in their origin, as the rock system to which they belong, and have suffered denudation from that time to this, by the same agencies, and *no other*, which now act through the whole year, upon the North American continent. Through each geologic change, the older valleys suffered, from widening and deepening, while hill tops were lowered.

In the undisturbed portion, running water has been the most efficient agent to break up and remove the rock masses. With the elevation of the carboniferous, along the Atlantic, drainage commenced. The channels of all the great rivers rising within it, were immediately marked out. Rain descending upon the plateau, gathered in pools, until it broke over its bounds, and descending the edges of the strata hewed out for itself a passage to the sea. In the early stages, there were many water-falls and cascades, but as the streams wore their channels backwards cascades were changed into rapids, and rapids into gently flowing streams. With the deepening of channels, banks would be undermined, the superimposed material would crumble and fall into the stream, currents would bear it along, estuaries, deltas, and the ocean would receive it. Thus, while the valleys increased in width, and the hills suffered diminution, the seas were filled up on the shore line by tidal deposits, the Atlantic was narrowed. and the interior seas filled up.

When I stand at the confluence of the Alleghany and the Monongahela, and behold those noble rivers in spring flood, turbid with sediment and debris, flowing through wide and deep valleys—and when I ascend their slopes to their summits, and there find but a narrow plateau to cross before I am compelled to descend into another valley as profound as the one from which I have emerged, I am not surprised at their depth, nor width; nor at the remnant which is left of the original high land, when I reflect that in the Permian early days these streams were but sluggish reedy waters, like the upper Mississippi; but they had a mission to perform, to fill up the cretaceous seas, which then had a shore line at Paducah, Ky., and Cairo, Ill. That was the work to be done. The Ohio has done its part. No wonder the carboniferous has been lost. It has been gnawed into fragments, and these fragments are the concrete of the new.

And as I stand on the Mississippi, and behold a valley ten, twenty, or even fifty miles wide, am I surprised at its width, when I reflect that it has been flowing in its present channel since the early days of the silurian!

When an engineer measures a borrowing pit, on the line of a railroad, he looks for some corresponding embankment, which shall equal in corresponding cubic feet to the earth removed from the pit. So when I measure a mile in height, and two and a half at its base, borrowed from the taconic, I find in the silurian where it has been transported. Or if I measure from the folds of the Alleghanies, fifteen hundred or two thousand feet in height, and eleven miles in length, at the base, I am not surprised at the loss, if along the line of the transporting power, I find twenty miles in width of dumping ground, in the Mesosoic—and a still greater width of cretaceous and tertiary, extending from Port Tobacco to Fortress Munroe.

How much of the continent will it take to fill up the Gulf of Mexico? To extend the Atlantic shore to the inner edge of the Gulf Stream? To unite Nautucket and St. George's shoals to Cape Cod? Sable Island to Nova Scotia? and the banks of Newfoundland to the Island of the same name?

Before this is accomplished, our valleys will be much wider and our lofty hills suffer a corresponding degradation. Given the soundings off shore, we learn the amount of material wanted—given the rapidity of the streams bearing their burden seaward, we shall know the time required for transportation. The work to be done, is not equal to that already accomplished. What the past has seen performed, the future may realize; the Highlands may be lowered to the level of the Hudson, and cloud-defying Round Top, be degraded to an insignificant hill.

Adjourned.

American Institute—Polytechnic Association, *May* 24, 1866.

Prof. S. D. Tillman in the Chair; T. D. Stetson, Secretary.

The meeting was opened by the presentation of the following selected items:

Isinglass.

The Gloucester *Telegraph* says that Rockport is almost alone in an old established, but quite a novel business, the manufacture

of "isinglass," or gelatine, from hake sounds. This business was established there nearly half a century ago, on a small scale, and has been since continued. We have mentioned that Rockport is nearly alone in this business, but perhaps we might say that it is quite so, since there is a similar manufactory at Ipswich, established and carried on by Rockport men, and so far as we know no other in this section of country. When the business was first established, some pretensions were made to a secret in the manufacture, but of late years it is generally known that there is n ingredient entering into the composition of this isinglass excepting the sounds of the fish.

The first efforts at making this isinglass were very crude, the whole work being done by hand power, the only machinery used being plain wooden rollers. Of late years, however, new and improved machinery has been introduced, and the works are carried on by steam power. The process is very simple, the sounds being thoroughly dried in the summer months, and when they are ready for use are cut up and soaked, and made to pass through sundry rollers, and exposed to a heating and drying process. The isinglass, when complete, comes out in transparent sheets or strips, rolled as thin as ribbon, and is ready for market.

The business is quite extensively carried on, and draws on all of the fishing towns of New England for the raw material, in the shape of sounds. But little is done during the summer months, but the manufactory is kept pretty busy during cold weather, and its production finds a ready sale. It is used for a variety of purposes, among others for the clarifying of liquors, sizing of cloth, etc., etc.

The preparation of isinglass was well understood by the ancients, and is now carried on in different countries, being produced from different species of fish in different lands. The best quality is that manufactured in Russia, said to be obtained from the sturgeon, a large fish of the Caspian sea and its rivers, and is a prominent article of commerce. Isinglass of an inferior quality is also manufactured in Brazil, from a variety of fish. In our own country, we believe, there are similar establishments in the State of New York, but with the exception of the two above named, none that we know of in New England.

Caviar.

The female sturgeon is much more valuable than the male.

The roes are there converted into a preparation largely used by Germans called "caviar," the original of which is made on the banks of the Volga, from a Russian species of the same fish. Except that the globules of the Russian article are larger, there is very little difference between the genuine article and the imitation that comes from the Delaware and the Hudson. The production of the stream first named, from some reason not to be ascertained, is very materially the best. Thousands of sturgeon roes have been thrown into the Delaware. They are now worth, on the banks of the stream, a dollar and a half each. When prepared in oil, converted into caviar, and sealed in tin cans, they bring from sixty to eighty cents a pound.

The Industrial Application of Oxygen.

When illuminating gas was first introduced it was compressed in strong vessels, just as soda water is at the present day, and delivered to customers in their dwellings. Very few persons had the temerity to suppose that it would ever be conducted through the city in large mains, and be passed into every house through connecting pipes.

We now hear of the organization of companies in France for supplying oxygen gas in portable receivers, the gas to be used for purposes of light and heat. We may, some day, have oxygen pipes carried along by the side of the illuminating gas, ready for the various applications to which it is adapted.

The only obstacle hitherto has been the expense. There are many substances which yield oxygen in abundance, but they are all too dear. M. Archereau has proposed the reaction of silica upon the sulphate of lime as a source of oxygen. When these substances are heated to a proper temperature, silicate of lime and two gases—sulphurous acid and oxygen—result. The former is used for the manufacture of sulphuric acid, and the latter it is proposed to compress into cylinders and sell by the cubic foot. The materials here used are very cheap, and the heat required to fuse them will be obtained from a mixture of common gas and oxygen. The silicate of lime could be used in the manufacture of glass.

The company which has been organized in Paris to make a trial of this process, asserts that it can furnish oxygen at the rate of two cents per cubic foot; whereas by the old methods, where the gas has been employed in the Drummond light, the oxygen has

cost nearly a dollar per foot. By directing a jet of oxygen through an ordinary gas burner, the illuminating power of the gas is greatly increased, and a saving of from forty to fifty per cent. effected. The introduction of the oxygen into the flame has also important consequences to health. It will destroy all the noxious gases which have escaped the purifiers, and only water and carbonic acid will result from the combustion. The amount of these latter will be less than usual, for the reason that greater illuminating effect is produced by the employment of a smaller quantity of gas.

By the combustion of illuminating gas and oxygen nearly the same heat is obtained as in the oxy-hydrogen blow-pipe. All metals can be fused by this means if placed in suitable crucibles; and the cost of large furnaces and expensive fuel will be saved in numerous industries.

The Chairman read the following paper on

The Galvanometer.

The name of this instrument implies that it is used in measuring the force of an electric current. It has not, however, been made entirely available for that purpose, owing to the fact that the action of the needle is not proportional to the force developed. For very short distances, say fifteen degrees from the line of rest, the arc described by the needle may be said to be as the strength of the current, because this arc and its tangent do not differ materially in length; but beyond that point the divergence of these lines increase so very rapidly the eye loses their relation. It is true that by means of the formula given many years ago by Amphere, with the requisite data, the graduation for a single instrument might be made nearly correct; still, as any change in the elements used would change the graduation, and as the liability to error in estimating the data is by no means inconsiderable, it will be readily seen the adaptation and adoption of a theoretical scale is impracticable.

Several empyrical methods for forming a scale of intensity have been devised. Those by Becquerel, Nobili, Melloni and Poggendorff, will be briefly noticed.

Becquerel and Nobili used a series of currents combined. They connected the galvanometer with a thermo-pile, and successively heated the alternate joints of one, two, three, four, five, &c., pairs of rods, and as the strength of the current was then as one, two,

three, four, five, or the number of pairs used, the resulting deflection was marked on the scale, and this established the relation for all cases. To carry the graduation through the whole quadrant required several series of plates. This method was only applicable to slight currents, such as were required in making very delicate experiments with bodies but slightly heated. The assumption that the current excited by heat would be uniform, and that the increase would be exactly in proportion to the number of heated joints, was not precisely true.

Nobili's method was to fix his graduation of the scale by differences. He assumed that the deflection of his galvanometer was proportional to the force of the current for the first twenty degrees, and he determined the graduation beyond this point by attaching to the galvenometer a thermo-pile and warming one end of the pile by bringing a spirit lamp near enough to it to cause a deflection of twenty degrees in the needle of the galvanometer. The pile was then screened until the needle returned to the zero point.

The next allowed the heat of a second lamp to fall on the other side of the pile, which produced a deflection of the needle in the opposite direction; the heat was regulated so that a deflection of twenty-four degrees was made. Both lamps were then allowed to act simultaneously on the pile, and he obtained by difference of the currents, a deflection not of 4° but of 5°.1. He therefore concluded that the current which produced a deflection of 24°, was the result of 20+5.1., or 25.1. units. In this way, by increasing the activity of the pile, he determined 28°–24, 32°–28, and so on, and afterwards filled in the intermediate degrees by the eye.

Nobili had tried this principle with a galvanometer having two wires connected with two batteries. He passed currents from them in opposite directions, first separately, and then together.

Poggendorff proposed to use one current, of uniform strength. The principle applied by him, is thus expressed in his own words, as translated by Dr. John D. Easter: "The deflections produced by currents of different strength, passing through the coils of a multiplier lying in a magnetic meridian, can be deduced from those produced by one and the same current, passing through the same coils, at various inclinations, to the magnetic meridian." The possibility of this is shown by geometrical considerations. Poggendorff proceeds to illustrate, by a figure, the force of the magnetism of the earth, tending to draw back a needle after having

been deflected, which force is the product of three factors, the intensity of terrestrial magnetism, the magnetic force of the needle, and the line of the angle of deflection. The form of the curve which represents the force with which the electrical currents tend to deflect the needle is determined experimentally. Apart from the geometrical construction, the rule may be thus expressed: To measure the force of a current which is greater or less than the assumed unit, observe, first, the deflection produced by it when the coils lie in the magnetic meridian; then turn the coils in the former case backward, and in the latter case forward, until the angle between the needle and the coils is equal to this angle of deflection. The sine of this angle of deflection, divided by the sine of the angle of deflection, produced after the rotation of the coils, is the ratio of the current towards the assumed unit.

The whole solution of the problem of Poggendorf, requires several printed pages for its proper explanation. It is more intricate, yet, doubtless, a nearer approximation to truth, than any other method yet presented. Our associate, Dr. Bradley, who is distinguished as a practical electrician, proposes to explain what seems to him a far simpler and more practicable method of making the galvanometer answer all questions regarding the intensity of the current which deflects its needle, and we now shall have the pleasure of listening to him.

On the Anthistometer.—By Dr. L. Bradley, of New York.

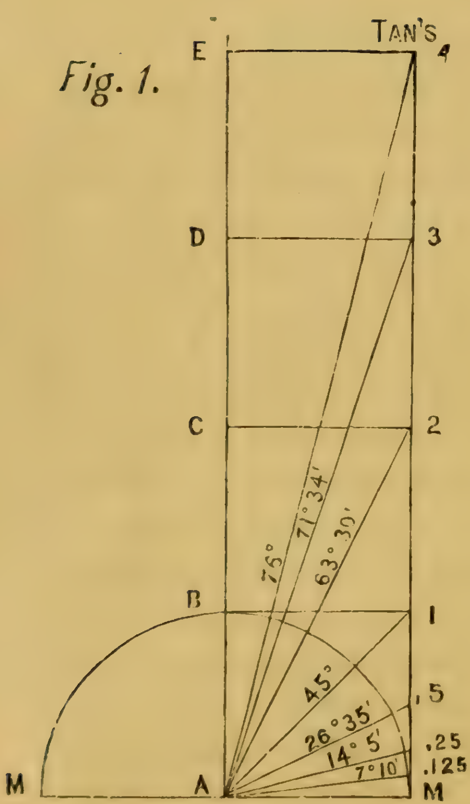
The Rheostat is an instrument for fixing the state and regulating the flow of a current of electricity. It has been employed under different forms by philosophers and professors, to prove theories and establish principles. I have enlarged its field of usefulness in making it a thing of every day practical utility in business. The improved Rheostat and the improved Tangent Galvanometer here exhibited, taken together, constitute an instrument for conveniently determining and correctly measuring the resistance which conductors of electricity oppose to the free propagation and transmission of a current through them, and the resistance of coils, magnets, batteries, &c. It is a *measure of resistance* to which I have appled the name *Anthistometer*, from the Greek, signifying a measure of resistance.

This instrument I have in constant use; and in my business, in relation to telegraphy, I have made it what the scale-beam or yard stick is in commerce. I have adopted the practice of mea-

suring and marking the resistance of all the magnets I put upon the market, which enables telegraph superintendents to arrange and adapt their magnets to the several parts of lines so as to secure the greatest economy in their use, which is a matter of very great importance. I make the *rheostat* daily useful also in comparing magnets and ascertaining their relative working qualities.

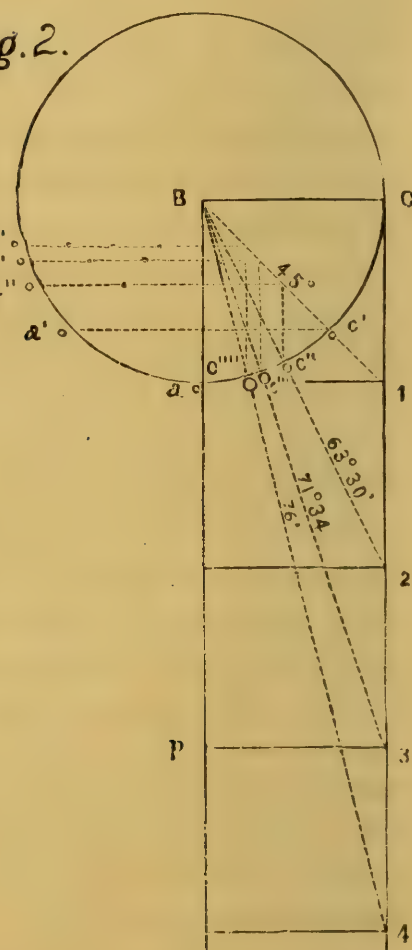
The subject of a uniform standard of resistance has engaged the attention of electricians considerably, but they have not as yet arrived at anything reliable. Wire of a given number is not only more or less variable in its dimensions, but is also variable in the specific resistance of the metal of which it is composed. The standard unit of resistance of this instrument approximates that of one mile of No. 8 iron wire. It consists of coils of different resistances, from the one-quarter mile to 150 miles, which are so connected with switches that any amount of resistance up to 1,200 miles can be introduced at pleasure; and the graduated sliding bar subdivides the quarter of a mile into hundredths of a mile. The true Tangent Galvanometer (Rheometer) measures correctly the strength or actual force of a current in circulation, which it may be demonstrated is directly proportional to the tangent of the angle of deflection. Common galvanometers do not fulfill the requisite condition for this, viz: that the adventitious force which is sent through the galvanometer coil shall act with the same uniformity upon the needle in all its deviations as the terestrial magnetism does. Where the coil is narrow and the needle long, the inductive influence upon the needle is very great while it is at or near the meridian; but, as it deflects, its extremities pass more and more away from the rays of induction, and consequently its deflections are less and less, so that the tangents of deflection are not at all proportional to the strength of current. To obviate this difficulty I made a coil of few layers carefully wound, whose width was equal to the length of the needle, but upon trial a difficulty in the opposite direction was manifest. When the needle is on the meridian over such a coil it is under the influence of but few convolutions of the coil wire, but as it deflects more and more, it comes under the influence of more and more of the convolutions, so that the effect, instead of diminishing, as in the former case, is more and more increased. Being now convinced that the truth lay somewhere between the extremes of these experiments, I resolved to find it if possible, and upon a

Fig. 1.



TAN'S
E
4
D
3
C
2
B
1
76°
71°34'
63°30'
45°
26°35'
14°5'
7°10'
.5
.25
.125
M
A
M

Fig. 2.



B
C
a''''
a'''
a''
a'
a
45°
c'
c''
c''''
63°30'
71°34
76°
1
2
P
3
4

little reflection the expedient was presented of making a compound needle, composed of several pieces or needles of thin flat steel, fixed horizontally upon a light flat ring of metal, and so trimmed as to form a complete circular disc of needles having an agate cup in the centre to rest upon the pivot on which it turns. At each extremity of the meridian light points project to indicate the degrees of deflection. The needles being polarized and balanced upon the pivot and placed over the coil, it was found to move with great celerity. This compound circular needle being under the influence of the same number of convolutions of the coil in all its deflections, it would seem, must necessarily fulfill the conditions required as mentioned above.

The theorem: "The intensity of currents, as measured by the tangent galvanometer, is proportional to the tangents of the angles of deflection," I verify in the following manner:

The terrestrial magnetism whose tendency is to direct the galvanometer needle to the magnetic meridian, I make the unit of directive force; and I let this unit be represented geometrically by the line A M, fig. 1, which is the radius of the circle M B M; the line M A M representing the meridian. When there is no other force acting on the needle, its direction is with the meridian. Now let an electric current be sent through the galvanometer coil, whose directive force is precisely equal to the terrestrial force, and whose tendency is to direct the needle in a line perpendicular to the meridian, and let this force be represented by the line A B.

If the terrestrial force could now, for a moment, be suspended, the needle would point due east and west; but the combined action of the two equal forces will direct the needle toward the point of intersection of the line drawn perpendicularly from M, and that drawn horizontally from B, at 1, which direction cuts the quadrant at 45°, the line M 1 being the tangent of 45°, which is 1.

Now, if we augment the intensity of the current through the coil to twice its present force, which will be 2, and will be represented by the line A C, the combined forces A M and A C will direct the needle toward the point 2. If we now lay a protractor on the circle, we find that the line A 2 cuts it at about 63° 30′, of which the tangient is 2.

We may increase the parallelogram, erected upon A M, at pleasure, and the two forces combined will always so balance the needle between them as to make it point from A, diagonally,

across the parallelogram to its opposite angle, the height of which is the tangent of the angle of deflection.

By inspection of the diagram it is seen that the law holds good in the subdivisions of the force A B, as at .5, .25, and .125, a truth admitted by all philosophers, as to the relations, up to 14°.

I believe that it is an admitted truth that the correlations of forces in magnetism are the same as those of gravity,—each within its own sphere; that of the former being confined within limits, while that of the latter is co-extensive with the universe.

Now, let us apply the principles of avoirdupois: here is a wheel which turns freely on its axis, and is graduated to degrees and minutes.

If we attach a pound weight to its periphery at (a) its tendency will be to maintain its position at the plumb-line P a B, which is the line of centres of gravity. Let us suppose the pound weight at (a) to be a constant quantity and a unit of force, corresponding to that of terrestrial magnetism, A M, fig. 1.

Now, if we attach to the wheel at C a force precisely equal to (a), whose tendency is to assume the position of the force at (a), we shall have two forces acting against each other, and whose relations to each other are the same as those of A M, and A B, in fig. 1; and they will so adjust the wheel that they will stand equally distant from the line of centres of gravity at a′ and e′, and the wheel will be found to have turned just 45°, the tangent of which is 1. If we now augment the force at c′ to twice its present weight, it will descend to c″, and, at the same time, the weight at a′ will ascend to a″, and the weight at a″ will be found to be just twice as far from the line of centres as that at c″, and the plumb-line will cut the wheel at 63° 30′, the tangient of which is 2. The augmented force is 2, and the tangent of deviation is 2. We may increase the force at c″ as we please, as at c‴ or c⁗, and the wheel will be so adjusted that the distance of the weight at (c), from the line of centres, as compared with that at (a), will be inversely proportional to its weight, and the plumb-line will cut the circle at the degree whose tangent is directly proportional to the weight.

Therefore, the intensity of currents of electricity, as measured by the true tangent galvanometer, is proportional to the tangents of the angles of deflection of the needle.

This galvanometer has three distinct coils. No. 1 consists of three layers of No. 32 copper wire, and gives 3.1 miles resistance. No. 2 consists of one layer of No. 28 wire, ane gives 0.4 miles

resistance. No. 3 is a simple plate of copper, whose resistance is *nul*, or so small that it need not be taken into account. No. 1 is for intensity, No. 3 for quantity, and No. 2 for common mixed currents.

I now employed a current from four cups of Hill's battery; first through coil No. 1, and then through coil No. 2, against different resistances, from 4.1 to 151.1 miles: the resistance of No. 1 being greater than that of No. 2, I was careful to switch in rheostat coils, so that the sum of resistances of the galvanometer, and the rheostat coils in the circuit should be always equal, thereby securing *isodynamous*, or equally intense currents.

The resistances introduced in five observations were 4.1 — 11.1 — 41.1 — 81.1 and 151.1 miles. The tangents of the several deflections by No. 1 being divided by those by No. 2, give the following quotients: 4.4 — 4.3 — 4.4 — 4.44 and 4.3.

The deflections by No. 4 were from 75 deg. to 8 deg. 30 min., and by No. 2, from 40 deg. 10 min. to 2 degrees. Such results give indisputable evidence of a very true tangent galvanometer. At the same time I noted the deflections of another galvanometer, whose needle is four inches long, coil one-half inch wide, and resistance .9 mile, under the influence of the same isodynamous currents. Dividing the tangents of No. 1 by those with this instrument I obtained the following quotients: 2.41 — 1.45 — .84 — .51 and .46. Showing how much more powerfully the needle of the old galvanometer was influenced when near the meridian, and how the effect diminished as compared with that of coil No. 1, when it deflected so as to carry its extremities more and more outside of the narrow coil.

Galvanometers have been constructed of large circular coils, open within, fifteen to twenty inches diameter, with a very short needle in the centre, which nearly fulfill the condition required; but the deviations obtained by a given current are small compared with those of an instrument whose needle is close to the coil, and a coil of much greater resistance is necessary. Such galvanometers are large, cumbersome, and inconvenient, and the changes in the deflections are too minute to ensure great accuracy in the observations.

Poggendorff, Melloni, Ampére, and others have published ingenious methods of determining the relative intensities of currents, by any common galvanometer, which may perhaps be sufficiently reliable for ordinary purposes, but in every case laborious compu-

tations have to be made and a table or scale arranged with great labor for each individual galvanometer, in order to make it available for any valuable purpose.

The expense and difficulties attending all such methods are such as to render them unavailable for men of ordinary means who cannot afford the requisite time and money.

To measure the resistance of a magnet or coil by the anthistometer, I put it in connection, between the two front screw cups at the left hand end of the rheostat; the galvanometer being connected between the screw cup at the right-hand end and one pole of the battery, while the other pole of the battery is connected with the rear cup at the left end. Now, if we turn the left hand switch to the left, the current goes through the thing to be measured, but if we turn it to the right, it goes through the coils of the rheostat. The resistance of these coils are designated by the figures over the several switches on the front as the equivalent of miles and fractions of a mile. I now turn the current upon the thing to be measured and observe to what degree the needle is deflected, and then turn it upon the rheostat and switch in resistance until the needle settles at the same degree. The sum of the numbers at which the switches now stand gives the resistance.

The switch which turns the current upon the magnet and back on to the rheostat, also the graduated bar and coil which measure hundredths of a mile, are inventions of my own, which give great facility in taking nice and accurate observations.

I have also discovered a new method of determining the resistance of a battery by the *anthistometer*. To do this I put a cup in connection, as I do a magnet whose resistance I wish to measure. The switches being all at 0, the needle deflects to — say 70 deg. 30 min. I now turn the current through the cup, the action of which being added to that of the main battery, the needle deflects to 72 deg. 40 min. I now reverse the current through the cup, so that its action opposes that of the main, and the deflection is 65 deg. 55 min. The tangents of the two extreme deflections are 3.204 and 2.237, which, being added and their sum divided by two, gives 2.720 for the mean tangent, of which the corresponding degree is 65 deg. 50 min.; by now turning the current through the rheostat and drawing the graduated bar to .20 the needle comes to the same degree (69 deg. 50 min.) The resistance of the cup is therefore .2 mile. In comparing two magnets for determining their relative working qualities, I remove the galvanome-

ter and put the two magnets in its place, both connected in the same circuit with the rheostat. Let the magnets be adjusted with equal fineness, and then gradually switch in resistance until one or both shall fail to operate. If there is difference in them the better magnet will continue to work after the other shall have ceased.

An interesting discussion followed, in the course of which Dr. Bradley said he had taken as his unit that adopted by our countrymen, Gen. Lefferts, and Moses B. Farmer, who had succeeded in producing a very compact and convenient form of rheostat, using spools of fine wire, the passage of the current through which was equal to any desired length of line. The doctor had arranged a series of these, adjusted with great care in a single compact instrument, provided with a delicate slide, lever, switches, etc., whereby a greater or less number could be turned on, so as to attain any desired amount of resistance, and show exactly what is the length of line equal to that resistance.

Some instruments for receiving and recording the signals used in telegraphing produce a resistance equal to ten or twenty miles of line, while others are so constructed or adjusted as to induce a resistance equal to 100 miles or more. The instruments with great resistance work with a weaker current, and are all adapted for certain situations.

The instruments having coils of slight resistance should be arranged along the middle of the line, and those of great resistance at the ends. This apparatus would measure and assort them with great facility.

Hill's Battery.

A great simplification of battery, lately invented by Dr. E. A. Hill, of Chicago, was also exhibited. This dispenses with the porous cup heretofore considered necessary between the two solutions. It had been found that the difference in the specific gravities was sufficient to keep them separate with proper care. Instead of arranging the zinc plate around the copper plate with the porous partition between, as in the popular Grove battery, Dr. Hill uses flat plates located one above the other with no partition between. The copper plate lies near the bottom of the cup, the zinc plate near the top. The cup is nearly filled with sulphate of zinc, and allowed to become quiet. The sulphate of copper is then gently introduced in the form of solid crystal which falls to the bottom of the cup and there soon dissolves. The result, the

familiar blue solution, lies in a tolerably distinct stratum at the bottom. Care must be taken not to introduce so much of the copper sulphate as to mingle quite up to the zinc plate, as in such case local action will result, and the copper will be deposited on the zinc, causing considerable mischief. To prevent the chance of this the plates are placed a considerable distance apart, which increases the resistance of the battery.

Dr. Bradley stated that he had tested this in his own practice as a manufacturer and fitter up of such apparatus, and commended it highly. He had found this battery less efficient, cup for cup, than the Grove, but the result was a greater economy. He estimated 100 of these cups equal to forty of the Grove, but the cost of maintenance of the whole was only about one-fifth. The consumption of materials was only one-half as great as by the very economical battery known as Chester's, or the Chromic Acid battery.

Smee's battery was very efficient in depositing metals for electro-metallurgical purposes, but was too irregular and too fiery to be recommended for telegraphing. It was very little used for that.

In practice, telegraphing was very much affected by the state of the weather. In good weather, 100 cups of the Hill battery, above described, operated eight lines—meaning eight wires—in the United States Company's office, while in bad weather it will work but two properly.

Mr. Stetson, the Secretary, said that imperfect insulation affected the efficiency of telegraphic communication very materially. Even webs produced by insects in some otherwise good forms of insulators, militated strongly against their success in wet weather, *particularly in gales of wind.* Every spider's web extending between the wires and the neighboring conducting surfaces serves as an efficient conductor to lead away the current. There is a loss at every telegraph pole.

After further debate on telegraphic improvements, the Association adjourned.

American Institute Polytechnic Association,
May 31*st*, 1866.

Prof. Samuel D. Tillman in the chair; Mr. T. D. Stetson, Secretary.

The following notes on science, from the pen of Prof. Joy, were presented :

A New Mineral.

Professor Wöhler, Göttinhen, has discovered a new mineral in some platinum ore of Borneo. It forms black, semi-metallic, very brilliant grains, similar to crystalized iron. The specific gravity varies from six to nine. It consists of a compound of sulphide of osmium and sulphide of ruthenium. This is the first time that the platinum metals have been found in combination with sulphur, and will at once be seized upon by the advocates of the theory that the sulphur in the auriferous pyrites of Colorado is in chemical combination with the gold, as gold is classed by them in the platinum group. Wöhler proposes the name "Laurite," for the new mineral, an account of which he will soon publish in the German journals.

Preparation of Pure Carbonic Acid.

Carbonic acid is employed in so many industries that its pure and economical preparation has engaged the attention of our inventors and chemists.

M. Ozouf, a manufacturer of artificial mineral waters, has proposed the following method : The carbonic acid resulting from the combustion of charcoal, or from any fire, is passed through a cold solution of carbonate of soda—all of the impure gasses pass off, while only the carbonic acid is absorbed and the simple carbonate becomes a bi-carbonate. The extra carbonic acid is afterwards driven off by heat and employed as desired, in a perfectly pure state. The carbonate of soda can be used repeatedly without undergoing any deterioration. This process enables the manufacturer to employ any convenient material for the preparation of carbonic acid in the first stage, as it is always pure in the second stage of the operation. Usually in the manufacture of soda water, the acid is obtained from marble dust, by the action of sulphuric acid upon it, and may be contaminated by invisible impurities in the marble.

It has been proposed to subject the gases resulting from combustion, to an immense pressure, by which only the carbonic acid

would be condensed to a liquid, while the impure gases would not be affected. There appear to be practical difficulties in the way of an application of this method. If it were feasible, it would have an application as a powerful freezing compound, as the solid carbonic acid produces a cold estimated as low as one hundred and eighty degrees below zero of Fahrenheit, and it could be used as a motive power in properly constructed engines.

Magnesium Light.

A peculiarity of the light produced by the combustion of magnesium, is that colors are not affected by it any more than by the light of the sun. A flower-bed lighted up at night reveals all of the natural colors, the same as in the day-time; and it has been proposed to use the light to distinguish the shades of color in silk and dyed goods at night, or during cloudy days. Numerous alloys of magnesium have been tried, but none of them with entire success. It is difficult in melting the metals to prevent the burning up of the magnesium. The alloy with lead burns very well, but the best results have been obtained with zinc. Alloys containing ten, fifteen or twenty per cent. of zinc, are easily drawn into wires and burn regularly, but produce much smoke, and act less powerfully in photography.

Nitrate of Soda.

This article of commerce is sometimes called Chili saltpetre; also cubic nitre. It is found in large quantities in Peru. Iquique is the small port on the coast where the vessels can take in their cargoes. The nitrate of soda is brought from a district of country ninety miles in the interior. This district, where the nitrate forms beds mixed with clay, has a circumference of fifty miles, and is called Atacama. The valley where the salt is extracted is thirty miles long and fifteen miles wide. The nitrate undergoes a crude washing in the valley; it is then put into gunny bags and placed upon the backs of mules for transportation to the coast. When it is desired to procure a cargo the simplest way is to go at once to Valparaiso to treat with the commission merchants, who will undertake to have the order filled. The traders embark all of the animals necessary to bring the soda, also their food, and even water to drink, as the country to be traversed has neither vegetation nor springs. It is a region of country which, at one period of our geological history, experienced such a bombardment of meteoric iron as the world has never since beheld. Masses of iron weigh-

ing thousands of pounds are found scattered over the country, and several thousand specimens have been enumerated.

The nitrate of soda was of great importance to us during our war. It enabled us to use all our saltpetre for the manufacture of gunpowder, as it supplied the demand for nitric acid, and thus released nitrate of potash from various other uses where it was formerly considered indispensable. The soda salt cannot be used for gunpowder as it absorbs moisture, but in other respects it can be substituted for nitre, especially in the preparation of nitric acid. The origin of the deposit is supposed to be the same as that of the beds of guano. Large accumulations of decaying organic matter have furnished the nitrogen, and alkaline lakes have provided the soda. It is to be hoped that the beds will not soon be exhausted, as the article is of great importance in the arts.

Indium.

Professors Reich and Richter published a preliminary notice of this metal in *Erdmann's Journal*, September 1st, 1863.

F. Reich is Professor of Physics at the School of Mines, Freiberg, Saxony. He is about seventy years of age, and is well known for his important investigations upon the density of the earth. He no longer delivers lectures but directs the practical operations of the laboratory.

Th. Richter is about thirty years of age, and was assistant to Professor Reich in the laboratory. He gives instruction in the blow-pipe, and has edited the work of the late Professor Plattner on metallurgy. He is a great favorite of the pupils of the School of Mines, and is destined, if he lives, to become one of the most prominent professors of the ancient school of Freiberg.

In consequence of the fact that thallium had been detected in a number of furnace products, it occurred to the professors to examine some impure chloride of zinc which they had obtained by distilling an ore which contained arsenic, sulphur, iron, zinc, manganese, copper, tin, and cadmium. To their surprise there was no green line of thallium, but two blue lines made their appearance on a different part of the spectrum. They immediately set to work to isolate the unknown body, and were soon successful. They proposed the name of indium from the color of the lines which lead to its detection. At this early stage all that they could say of it was that sulpheretted hydrogen did not precipitate it from acid solutions of the chloride; that ammonia

throws down an oxide, and that it was easily reduced before the blow-pipe to a metallic bead. A second paper by the same authors appeared November 16, 1863. In this the position of the lines on the scale was more fully defined. If the soda line was at fifty, and strontia at 104, then the two indium lines would be at 110 and 147. A pure salt of indium in the flame of a gas-burner or alcohol lamp, imparts a violet color. They also found that the source of the metal was the blende, and were able to recover 0.1 per cent. indium from metallic zinc.

A third paper, October 7, 1864, gives us further properties. The oxyd is easily reduced by hydrogen gas the same as the oxyd of copper, and can be melted to pellets in a glass tube. The hydrogen gas, after passing over the metal, burns with a blue flame. The metal is white, brighter than tin, approaching the luster of silver. It is very soft and ductile, and retains its luster in the air and in water, even in boiling water. Its specific gravity was found to be 7.17, on three determinations; according to Winkle it is 7.36. The point of fusion is the same as that of lead. Its oxyd does not appear to color glass. It is soluble in hydrochloric and sulphuric acids with evolution of hydrogen gas; is also easily soluble in nitric acid. It is completely precipitated from acid solutions as a hydrated oxyd by ammonia and potash, insoluble in an excess of the reagent; the principal distinction from zinc and cadmium. The hydrated oxyd is pure white, and peculiarly slimy, on which account it adheres to the sides of a vessel. Tartaric acid prevents the precipitation of the oxyd. The oxyd after heating and cooling, becomes of a straw-yellow color. Sulphuretted hydrogen does not precipitate any material amount of the metal from strongly acid solutions. The behavior is like zinc in this respect. From solutions in acetic acid sulphuretted hydrogen throws down a beautiful yellow sulphide of indium, recalling sulphide of cadmium, and this affords a method of separation from iron and manganese.

The chloride of indium resembles chloride of aluminum and can be prepared in the same way, by passing chlorine gas over the oxyd, mixed with carbon. It is very hygroscapic, and can be driven from one place to another in the tube. The sulphate crystalizes in small white scales.

The atomic weight is 37; according to Winkler, 35.9.

The preparation of indium from blende is as follows: The blende is digested in *aqua regia*, and sulphuretted hydrogen

passed through the solution to precipitate all of the copper, lead, arsenic, tin, cadmium and molybdenum; oxydize the filtrate from the above, and then add a large excess of ammonia, by which the greater portion of the zinc will be dissolved and separated; dissolve the precipitate produced by the ammonia in acetic acid, and throw down the indium as a sulphide by means of sulphuretted hydrogen. In order to obtain a pure salt, this latter operation will require to be repeated a number of times.

The metal is more easily obtained from a granulated zinc than from blende.

Schrötter has found indium in the blende of Schönfeld, near Schlaggenwald. He roasts the finely stamped ore and digests it in sulphuric acid, and throws down the indium by metallic zinc, in the same manner that thallium is precipitated from its solutions. Schrötter has also determined the exact position of the indium lines with reference to Kirchhoff's chart of the solar spectrum and the photograph of the spectrum taken by Mr. Rutherfurd, of New York.

Mr. Rutherfurd's photograph is now accepted as the standard of measurement by the physicists of Europe, and is regarded as one of the most valuable contributions to science ever received from this country.

Streng has found indium in the furnace products of the Hartz mountains.

Professor Joy has examined fifteen specimens of blende, from as many localities, in widely separated portions of the United States, but thus far no trace of indium has been discovered.

The effect of indium upon the fusibility of alloys, has not been determined, but reasoning from analogy, it appears probable that it would lower the point of fusion, the same as cadmium.

There is every reason to expect that the indium blende will be discovered just as a cadmium blende was found on the estate of Lord Greenock, in Scotland. What influence the bromide and iodide of indium would have in photography, also remains a question for investigation.

Indium is emphatically a metal of the future.

Rubidium.

This metal was discovered by Bunsen and Kirchhoff in 1861. Bunsen is a native of Goettingen, and is a cousin of the late Chevalier Bunsen, so well known for his theological writings.

Robert Bunsen is about 55 years of age. He was at one time tutor at Goettingen, where he published a paper on the employment of the hydrated oxide of iron as a remedy for poisoning with arsenic. This was one of the earliest scientific investigations made by him. Afterward he traveled somewhat extensively—was appointed Professor at Marburg, later at Breslau and lastly at Heidelberg, where he had built up the largest scientific laboratory, excepting perhaps Goettingen, to be found in Germany.

Kirchhoff is not yet forty years old. He is Professor of physics and a great favorite of Bunsen. The two are much together, and throw ideas and work into each other's hands. Bunsen was engaged in 1859 and 1860 in the examination of the colored flames produced by the combustion of certain substances. He examined these flames through different media, and found that he could distinguish potash in the presence of soda by viewing the flame through cobalt-glass. He afterward employed a wedged-shaped or prismatic bottle, filled with ammonia sulphate of copper, to distinguish lithia, strontia, and potash. We can well understand that the transition from colored glasses and prismatic bottles to flint glass prisms was very natural. He viewed the light from burning bodies through prisms, as Fraunhofer, Draper, and others had done, and found that each substance produces its characteristic spectrum.

This discovery excited his interest, and he prosecuted the examination of every known substance with the greatest zeal. He and Kirchhoff determined the lines formed by all the known substances, and they found new lines which they thought must be due to new bodies. They gave the name of rubidium to the metal, which yielded a red line very near to the potash line, and outside of Fraunhofer's line A. Having discovered and named the new element, the next thing was to study its properties and ascertain where it could be found.

They first detected it in the mineral waters; afterwards it was found to exist in small quantities in lepidolite, fieldspar, carnallite, crude saltpeter, tobacco, coffee, tea, sugar beet, commercial potash, triphylline, and other materials. Metallic rubidium can be prepared from the bi-tartrate in identically the same manner as potassium. It is more difficult to reduce than sodium, but more easy than potassium. It melts at 204° F. (Potassium 144° F. Lithium 356° F.)

The atomic weight of rubidium is 85.36. It decomposes water

the same as the other alkali metals. The salts of rubidia resembles those of potash and soda. The tartrates and the platinum salts vary in solubility, otherwise it would be difficult to distinguish between them.

It now remains to discover some mineral containing sufficient rubidium to enable us to study its use in the arts. One of the richest minerals is the lepidolite of Hebron, in Maine; according to Johnson and Allen of New-Haven, this ore contains 0.24 per cent of the oxide of rubidium.

It is not probable that metallic Rubidium will ever play an important part in the arts, but its salts may possess different medicinal properties to potash and soda, just as lithia is given as a subttitute for those alkalies. What properties this alkali would impart to glass also remains a question for the future. We may discover it in sufficient quantities for use in the manufacture of soap.

Cæsium.

This metal was discovered at the same time and under the same circumstances as rubidium, by Bunsen and Kirchhoff. Bunsen, in his capacity of Counsellor of State, is called upon for advice in sanitary matters, and everything relating to mineral springs is submitted to him for examination. He had the residues from the evaporation of an enormous quantity of the Duerkheimer Spring sent to him. He took 80,000 pounds of this water, and was able to prepare from it a few grains of the oxide of cæsium upon which to found his investigation into its properties. It appears to be less abundant than rubidium, and the two are commonly found associated together. Bunsen was not able to determine the atomic weight of cæsium with entire accuracy upon the small quantity at his command, and this valuable work was accomplished by Johnson and Allen of Yale College. They give the atomic weight as 133., hydrogen being taken as unity. It has the highest atomic weight of any of the elements excepting gold, which is 197.

The salts of cæsium produce sky-blue lines on the spectrum, and hence the name.

Cæsium and rubidum, in all their compounds, resemble potassium so closely that they cannot be distinguished from it by reagents or before the blow-pipe. They can only be recognized by means of the spectroscope, and render that instrument indispensable to the analytical chemist.

Rubidium and cæsium yield alums with alumina and sulphuric acid, and the difference in the solubility of these salts affords a method for their separation.

The ratio of solubility of the alums is:

Potash	22
Cæsium	4
Rubidium	1

A very interesting discovery was made by Pisani, of Paris. A gentleman, who had a collection of minerals, sent a number of them to Pisani to have them properly named and described. They were all of them examined before the spectroscope. One of them known to mineralogists under the name of Pollux, was found to give the blue cæsium lines with remarkable definition. It was subjected to a careful analysis, and found to contain the extraordinary amount of thirty-four per cent of the oxide of cæsium. The mineral pollux occurs on the Island of Elba. It resembles some varieties of fluorspar, and crystalizes in the same form.

We would call attention to this fact, as it may eventually be found in the United States.

During the year 1865, Bunsen was occupied collecting material from which to prepare metallic cæsium. He intended to reduce the bitartrate in the same manner as he had followed in the preparation of metallic rubidium.

The uses and practical application of cæsium are subjects of investigation. It may, hereafter, for aught we know, play a very important part in the arts.

Roofing.

The chairman, in introducing this subject, spoke of the use of pulverized slate mixed with coal tar; also of calcined clay and coal tar, and said unless very great care was taken in putting these materials on, there would be danger of its cracking. The evidence on the value of this kind of roofing is now conflicting—some commending and others condemning it.

Dr. Hirsh said that if the coal tar is put on thin it will not crack. In Europe they have roofing paper, not only water-proof, but fire-proof, and is used in some fire-proof safes. Soluble glass is mixed with it.

Dr. Thompson, of Auburn, Cayuga county, N. Y., remarked that this coal tar roofing has been much used at Auburn. On a warm day the tar melts and runs off, and in a short time none of

the tar will be left. The union of the coal tar and the sand is simply a mechanical union; all that he had seen used would not answer in extreme cold weather, as it cracks. The best roofing paint he found to be that made with oil, the same as painters prepare, with the addition of a small quantity of beeswax, which renders it elastic. This can be put on paper, layer after layer, and will make a tolerably good roof. The addition of graphite to this paint makes it still better.

Mr. S. H. Maynard said: Roofing material, made of tar and soapstone powder, mixed in equal proportions, has been put on roofs at the Middlefield quarry, and they have required no repairs for four years. There is also a building there covered with this material eleven years ago, and is in good order now. If coal tar could be had readily in the country, it would no doubt be the best for covering barns.

Dr. Thompson stated that he found Blake's roofing paint, mixed with coal tar, a very desirable and lasting article.

Mr. J. Wyatt Reid said that if there was any peculiar property in powdered slate for roofing, it was due to its laminated, and not to its angular qualities.

Mr. Griffin presented samples of water-proof roofing, which was made as follows: 1st. There is a heavy foundation of saturated water-proof felt. 2d. A layer of composition. 3d. Another layer of felt. 4th. Another layer of composition. 5th. Another layer of felt.

The whole is pressed into one solid impermeable fabric, and put up in rolls fifty feet long by two feet wide, and when nailed upon the roof-boards, is finally covered all over with a surface coating of cement and sand, and thus is completed a roofing differing from all heretofore made. It unites the best kind of water-proof composition with the best water-proof fabric. It has been put on buildings of all descriptions, and in all climates, and can be applied to steep or flat roofs, old or new, and by ordinary workmen, at a trifling expense. The manner of combining the materials employed in the construction of this roofing, by which it is made into one firm, impermeable, uniform fabric, increases its durability, while at the same time, being manufactured by machinery, on a large scale, the cost is lessened.

The Chairman made the following remarks on

Nitrous Oxide.

This compound was discovered by Dr. Priestly, in 1776. It is gaseous at ordinary temperatures, but may be reduced to the liquid state, under a pressure of 750 pounds per square inch, at 45° Fah. At about 150° below zero, it becomes a solid, without the aid of pressure; and boils at 126°. A single drop of the liquid upon the skin will wound it like a burn. The solid, mixed in vacuo with the bisulphide of carbon, produces the most intense cold, equal to 240° F. or 140° Cent.

Gaseous nitrous oxide is colorless and transparent, and has a slightly sweetish taste, and an agreeable odor. Estimating the atomatic weight of oxygen at 16, instead of 8, this gas consists of two atoms of nitrogen and one of oxygen; formerly eight was the combining number of oxygen, and as the combining proportions were in this view equal, the gas was called the protoxide of nitrogen; under the new atomic weights it is a sub-oxide. Reckoning an atom of nitrogen weighing 14 by the letter n. and an atom of oxygen by the letter t, and prefixing vowels in their regular order to distinguish the number of atoms employed, according to the new chemical nomenclature, we would express solid nitrous oxide by the word *enat*, signifying two atoms of nitrogen and one atom of oxygen, and nitrous oxide gas by *genat*. Common air is an impure mechanical mixture of these two gases, and contains about four volumes or atoms of nitrogen to one volume or atom of oxygen. Thus it will be seen that nitrous oxide contains about twice the quantity of oxygen found in an equal bulk of common air. The relative quantity of these gases in all their known combinations, without the presence of any other element, will be readily comprehended by the following new names:

	Proportion.
Protoxide of nitrogen or nitrous oxide	*enat*, 2 to 1.
Deutoxide of nitrogen or nitric oxide	*enet*, 1 to 1.
Nitrous aubydride	*enit*, 2 to 3.
Peroxide of nitrogen	*enot* or *anet*, 1 to 2.
Nitric anhidride	*enut*, 2 to 5.

The higher oxides part with their oxygen very rapidly in the presence of most of the other elementary substances, but nitrous oxide in the gaseous state has no immediate disorganizing effect upon the human body.

Sir Humphrey Davy, about the year 1800, studied minutely the qualities of nitrous oxide, and as it contained only the main constituents of common air, he was induced to try its effect upon himself by breathing it, and was the first to discover that its inhalation produces an exhilerating effect upon the nervous system, and hence it was afterwards known by the popular name of laughing gas.

Dr. Henry said, as early as 1823, "that although this gas proves fatal to animals wholly confined in it, yet it has no injurious effect when admitted into the human lungs, because it is there mixed and diluted with the air present in that organ. To administer the gas it may be introduced into an oiled silk bag or clean bladder, furnished with a stop-cock, and may be breathed repeatedly from the bag and back again as long as it will last. The sensations that are produced vary greatly in persons of different constitutions; but in general they are highly pleasurable and resemble those attendant on the early period of intoxication. Great exhileration, an irresistible propensity to laughter, a rapid flow of ideas and an unusual fitness for muscular exertion are the ordinary feeling it produces. These pleasant sensations, it must be added, are not succeeded, like those accompanying the grosser elevation from fermented liquors, by any subsequent depression of nervous energy."

Such was the estimate of the effect of this gas more than forty years ago. It has been said some disastrous consequences have followed the breathing of this gas, but in these cases the evil doubtless arose from using an impure gas. The gas is most readily made from the nitrate of ammonia which is resolved into nitrous oxide and water by applying from four to 500° F. of heat, but if a higher heat is employed, it is said, nitric oxide is also formed. With proper care, however, a very pure gas may be made by first forming the nitrate of ammonia from pure carbonate of ammonia, subject to the action of pure nitric acid—and submitting the resulting nitrate to a very regular temperature not exceeding 500° F.

The effect of inhaling nitrous oxide, as already described, is rapidly changed if the process is continued, and the laughing gas then acts as a sedative. The overcharged nerves are suddenly relaxed and the inhaler sinks into a dreamy and unconscious state. In this condition he is wholly insensible to pain, but insensibility to pain does not wholly arise after unconsciousness. In some cases

this condition is attained while the subject is still in the ecstatic state and endowed with more than normal power, and it was the observation of this fact which led Dr. Horace Wells of Hartford, in 1844, to one of the most important discoveries ever made. Dr. Colton, the gentleman who will address you this evening, was present when the idea of Anæsthesia flashed upon the mind of Wells, and will give you all the interesting details of his connection with the experiments then made, Dr. Wells being the first to make a practical test of his theory upon himself. The scientific world have quite generally acknowledged Dr. Wells to be the author of Anæsthesia. The medical profession were at first incredulous as to the power of nitrous oxide; and the inconvenience of making and using it for each case, together with the impression that its effects could not be prolonged, prevented its early adoption. Two years after Dr. Wells had demonstrated that exhilerating gas when inhaled destroyed or allayed pain, Dr. Morton, a dentist at one time under Wells, tried, at the suggestion of Dr. Jackson, another exhilerating volatile, ether, which, like nitrous oxide produced the same insensibility to pain. This substance was very soon and quite generally applied by operating surgeons. At a later day a similar application was made of chloroform, a compound first produced by Mr. Samuel Guthrie of Sackett's Harbor, N. Y., in 1832, and first administered by inhalation for the purpose of curing diseased lungs, by Prof. Fisk of Yale College. Dr. Simpson of Edinburgh, applied it in surgical cases long after Morton and Jackson had used ether. Several other anæsthetics have been used. While ether and chloroform are still more generally used, it is evident nitrous oxide is rapidly gaining favor, not only among dentists, but among surgeons who have all the facilities for making and using it.

Dr. G. Q. Colton was introduced to the audience, and after administering nitrous oxide to a person who desired a tooth extracted, and successfully performing the operation, the Dr. gave an interesting account of his first giving the gas to Dr. Wells, the discoverer of Anæsthesia, May 11, 1844.

The Association then adjourned.

American Institute Polytechnic Association,
June 7th, 1866.

Prof. S. D. Tillman in the chair; Mr. T. D. Stetson, Secretary.

Improved Steam Hammer.

Dr. Rowell exhibited Shaw & Justice's steam hammer. An upright frame is fitted to a transverse shaft at the top, on which is a crank-wheel; to this crank is attached a connecting rod. This rod is attached to a spring and works the hammer in a guide-brace. The hammer, in its reciprocating motion, strikes with a force proportioned to its velocity. When the revolutions of the driving wheel are increased rapidly the efficiency of the machine is very great—a hundred pound hammer being capable of drawing a four inch bar down to any desired thickness at one heat. It strikes with almost irresistible force, and is equal in round numbers to a blow of 20,000 pounds weight.

Improved Mouth-piece for Inhaling Gas.

Dr. White exhibited and explained his improvement in the mouth-piece of bags for inhaling nitrous oxide gas, by which the pure gas is inhaled at every respiration. The gas being once respired is not allowed to mix with the breath and again enter the bag, but at every exhalation a valve opens and the expired breath passes into the air. The corpuscles of the blood are concave, but when acted upon by alcohol, ether or chloroform, they become convex. Nitrous oxide changes dark blood to red. Blood acted on by alcohol is of a brick color, and no amount of agitation will restore it to its original appearance. But after the use of nitrous oxide, however, we find that the blood returns to its original color. Dr. W. preferred to give the gas when there was no catarrh present, through the nose, as in that case the masseter muscle is not contracted or rigid, but by breathing through the mouth this muscle will become so fixed that the operation of teeth-drawing will be very difficult. When a person, before taking the gas, was crying, after the effects of the gas have passed off he will begin to cry exactly at the point where he left off. He would not say that breathing the gas was not dangerous, as deaths have occurred from it; but if a little caution is exercised no fears need be entertained. He had used it over a year with no unpleasant result. If air is mixed with the gas the patient will know everything that takes place. He kept Dr. Chamberlain in this condi-

tion for three-quarters of an hour. He took twenty-three teeth from a lady, and she said she felt no pain whatever. There is no stertorous breathing with this mouth-piece. With this appliance he could keep a person under the influence of the gas as long as by any other anæsthesia, but it could not be denied that there are persons who, if they breathe this gas, it would be fatal to them—such persons as have ossification of the heart should avoid its use. It takes from thirty to sixty seconds to produce anæsthesia. In one case this afternoon he took fourteen teeth out, and two and a half minutes elapsed before the gas took the proper effect. Dr. White administered nitrous oxide by his improved mouth-piece to some of the audience, but was not as successful in producing insensibility as Dr. Colton at a previous meeting.

Mr. J. Hirsh said in Germany, on the Rhine, many persons die every year from drinking young wine—there is so much carbonic acid in it; and Prof. Liebig has shown that it is only in the young wine that this excess of the gas is found.

Dr. J. W. Richards exhibited an apparatus for producing local anæsthesia, the invention of Dr. Richardson, of London, and read a description of the apparatus from N. Y. Medical Journal for May, 1866.

After a discussion of the feasibility of producing local insensibility by means of cold, the Association decided to take their summer vacation, and thereupon adjourned to Thursday, Sept. 13th.

AMERICAN INSTITUTE POLYTECHNIC ASSOCIATION,
September 13, 1866.

Prof. S. D. Tillman in the chair; Mr. T. D. Stetson, Secretary.

On resuming the chair the presiding officer said:

We assemble under auspicious omens. The war-flags of the great nations of the earth are again furled. Commerce, unmolested, seeks foreign seas and enlivens all the channels of inland traffic. The workshop resounds with the hum of industry, and the factory vibrates with the labors of the ponderous engine. While activity pervades all departments of business, those who devote themselves to new investigations are not idle. Science continues her researches. Invention and discovery draw, from illimitable sources of novelty, fresh means for the amelioration and material well-being of man.

Since the adjournment of this association, in June last, many scientific journals have been received freighted with the rich treasures of recent investigation. To these, however, I do not propose, this evening, to direct your attention.

Several scientific societies have met during the past summer. One of these meetings I attended, partly in an individual capacity and partly as the representative of the American Institute. I have deemed it my duty to report to you some of the more important proceedings of that body.

The American Association, for the advancement of science, after a silence of five years, resumed active operations at Buffalo, N. Y., on the 15th of August last. Its meetings were held in the splendid edifice of the Young Men's Association, which contains a reading room for ladies, as well as gentlemen; a valuable cabinet of minerals, the gift of Mr. Wadsworth; a large collection of organic remains, principally copies of specimens now in European museums; also, rooms devoted to the fine arts: the whole is in connection with St. James' Hall, in which the Hon. George W. Clinton delivered an admirable address of welcome to the American Association, to which President F. A. P. Barnard made a felicitous reply.

After one section on Natural History and another on Physics and Mathematics were organized, the members proceeded to business. I do not propose to notice the papers in the order in which they were read, but only to speak of those which came more immediately under my own observation.

Two papers were read by Prof. Loomis, of Yale College, neither having at present any practical bearing. The first, "On the physical condition of the sun's surface and the movement of the solar spots," contained no new observations, but gives a graphic description of the shape, shading and movement of the solar spots; their direction being from east to west, with a decrease of angular motion near the equator. The second paper, "On the period of Algol," contained several ingenious surmises, which, of course, cannot lead at present to any satisfactory conclusion. Algol belongs to that remarkable class of orbs which are subject to periodical fluctuations in brightness. In a little less than three days its light increases from that of a star of 2.3 magnitude to that of the 4th, then decreases to its minimum intensity. Prof. Loomis gave the observations of Argelander, in 1854 and 1856; Masterman, in 1859, and his own in 1865, as well as earlier

observations, the first being in 1784. He finds an increase of about three seconds between the minimum observed by him and those noted in 1859 by Masterman. These periodical changes have been the subject of much speculation among astronomers, but, while nothing is known with certainty, regarding the cause of light in our own sun, it seems useless to attempt to explain the cause of the variable illumination of a self-luminous star or sun situated at an immense distance from the solar system. It is, however, important to record, with all possible accuracy, frequent observations of celestial changes, because they may hereafter materially assist in the solution of problems now altogether beyond our grasp.

E. B. Ellicott, Esq., of Boston, read a paper on the

Mutual Action of Elements of Electric Currents.

The law of Ampere—that commonly recognized as expressing the action of two independent elements (or infinitesimal portions of electric currents)—was based on an assumption, and on four cases of equilibrium experimentally determined. The assumption of Ampere was that the direction of the action was *constant*, independent of the relative directions of the elements, and that the quantity of intensity of the force raised with the direction of the elements. The new assumption was the reverse of this—to wit: that the intensity of the resultant is independent of the direction of the elements; but that the direction of the resultant varies with the direction of the elements. The latter view more closely corresponds to the doctrine, now generally admitted as established, of the conservation of the physical forces. It is also, in form, more analagous to the law expressive of the natural action of material masses under the influence of gravity.

In the case of gravity the action was proportioned directly to the product of the masses, and inversely to the square of their distance. In the case of electrical, the current's direction of the elements is to be taken into consideration; and the resulting force may be expressed as the product of the quotients of each element, (considered both as to strength of current and length and direction of element) divided by their distance (also considered both as to length and direction); the consideration of direction involves the application of the newly developed principles of the mathematical science of quatemoris.

The law above mentioned having assumed all the ordinary spe-

cial laws of electrical action flows necessarily therefrom, to wit: the mutual action of electrical elements, the mutual action of closed circuits, and the action of magnets considered as solmoids.

Great interest is attached to this paper of Mr. Elliott's from the fact that the author has resorted to quartermoris to aid him in arriving at the conclusions stated.

The calculus of quartermoris was invented by the late Sir William Rowan Hamilton, of Dublin, and the first publication of them was in 1853. In 1855 it was spoken of by Prof. Pierce, of Cambridge, as a system of great importance, and likely to be extensively used in future mathematical investigations. In 1859, Prof. Tait, of Belfast, made use of quartermoris in determining Fresnel's wave surfaces.

Among the most important papers presented were those of Dr. T. Sterry Hunt, F. R. S., of Montreal. The following is a synopsis of that:

On the Laurentian Limestones and their Mineralogy.

The author alluded to the existence in the lower Laurentian system of three limestone bands or formations of great but variable thickness, which might fairly be compared with the great limestone groups of the North American paleozoic system. In addition to these there is probably a fourth and newer limestone formation belonging to the lower or true Laurentian, besides one or more in the unconformable overlying Labrador series or Upper Laurentian. The three limestone formations first named are separately great masses of gneissic and quartz ore strata, and are intimately associated with beds in which silicates of lime and magnesia prevail, together with graphite and various metallic ores. The minerals associated with these limestones and their accompanying strata were next considered, and it was shown that they occur both disseminated in the beds and filling fissures or veins which traverse the strata. The importance in a geological point of view of these veinstones which from their mode of formation might be named *endogenous rocks* was insisted upon. They may attain very great dimensions and may include any or all of the mineral species belonging to the adjacent stratification, variously grouped, and sometimes having a banded arrangement parallel to the walls of the vein. Among the characteristic minerals of these veins are calcite, apatite, proxene, hornblende, serpentine, chondrodite, orthoclase, scapolite philogopite, quartz garnet, idocrase, epidote,

spinel, corundum, sphene, zircon, magnetite and graphite. Some of these occasionally occur in a nearly pure state filling the veins as graphite, proxene and apatite. Veins of crystalline carbonate of lime, generally including some one or more of the preceding minerals are often met with, and it is these which have given rise to the notion maintained in this country by Emmons, and in Europe by Leonhard and others, that crystalline limestone is either partially or entirely of eruptive origin, these calcareous veinstones having been confounded with intrusive dykes. From such veinstones a transition may be traced to those in which orthoclase and quartz prevail, often to the exclusion of lime and magnesia compounds. We have then true granitic veinstones in which tourmaline, beryl, muscovite, cassiterite and columbite are sometimes met with. These *endogenous rocks*, in which are often concentrated the rarer chemical elements of the rocks, are to be carefully distinguished from intrusive dykes which are *exotic rocks*. Such veins are not peculiar to the Laurentian system, but are found in crystalline strata at various ages. The crystalline limestones of Scandinavia, which offer so many remarkable resemblances to those of New York, New Jersey and Canada, are however of Laurentian age, and the nature of their veins has been well understood by Scheerer.

The rounded angles of crystals of certain minerals from the calcareous veins of the Laurentian system, especially of the crystals of apatite and quartz, which Emmons had supposed to be due to a commencement of fusion, is to be regarded as the result of a partial resolution of the previously deposited crystals, and as marking a stage in the progressive filling of the veins. Crystals of orthoclase pyroxene, sphene and zircon, though accompanying these rounded crystals, retain the sharpness of their angles because of their permanence in the heated alkaline solutions which circulated through these yet partially filled veins. The various minerals of these veinstones have been deposited from aqueous and saline solutions at elevated temperatures, and the experiments of Daubree and of De Senarmont and the microscopic observations of Sorby, support this view. Plutonists begin to understand that water cannot be excluded from rocky strata, but is all-pervading, and that at greater depths, kept by pressure in a liquid state at an elevated temperature, and having its solvent powers augmented by alkaline salts, it plays a most important part in metamorphosis and the formation of veinstones. The author supposed, with Mr.

Hopkins, that in earlier geological periods the increase of temperature in buried strata was far more rapid than at present, so that great heats prevailed at comparatively small depths from the surface and produced great chemical and molecular changes. The temperature at which the various silicated and other minerals, including graphite, were dissolved from the strata and crystalized in the veins, he supposed to have been, judging from various analogies, between the melting point of tin and low redness.

The distinction between the apatite, graphite and magnetite disseminated in the beds and the same minerals in the veins was particularly insisted upon. As to the origin of the principal silicious minerals of the limestones, such as serpentine, chondrodite, pyroxene sensellacrite and loganite. Dr. Hunt regards these as having been directly deposited as chemical precipitates from the seas of the time, and cites the example of the *Eozoon Canadense*, an abundant fossil of the time, found imbedded in these silicates which enclose it, and fill the minute pores of its calcareous skeleton. To a similar chemical precipitation he attributes the serpentines, talcs, chlorites and epidotes which occur in more recent rocks and may be found in their incipient state before the metamorphosis of these rocks, which has for the most part only crystalized and rearranged the already formed amorphous silicates. The chemical agencies which gave rise to these silicates of lime, magnesia, iron and alumina were briefly discussed, and declared to be still active, although probably to a less degree than formerly.

The following is a condensed statement of the points discussed by the same author in his paper on

The Primeval Atmosphere.

Dr. Hunt adverted, in commencing, to a theory first put forward by him to explain the chemical conditions of our globe. Starting from the notion of an ingeneous origin, he had contended that the mass probably commenced cooling at the center, and thus gave rise to an anhydrous solid nucleus, having a crust of silicates with an irregular surface, while the chlorine, carbon and sulphur, together with all the hydrogen and an excess of oxygen, formed the atmosphere. As cooling from radiation went on, the first precipitate from this dense atmosphere must have been an intensely acid liquid, which attacking the crust of silicates separated vast amounts of silica and became saturated with earths and alkalies, forming the primeval sea. This condition of things he claimed

was in strict accordance with the known chemical laws, and flowed logically from the hypothesis of the ingeneous origin of our planet. The early ocean should thus abound in salts of lime and magnesia, and this is confirmed by the saline waters from the Paleozoic rocks, which represent fossil sea water of that ancient period. Dr. Hunt here referred to his extended chemical and physical investigations of the older rocks and their mineral springs in support of this view.

The stronger acids of chlorine and sulphur having been separated from the atmosphere, a decomposition of the silicates of the exposed portion of the earth's crust under the influence of carbonic acid moisture and heat went on, resulting like the modern process of kaolinization in the production of a silicate of alumina or clay and carbonates of the protoyed basis. In this way great quantities of carbonate of soda were formed, which, decomposing the lime and magnesia salts of the sea, gave rise to the first limestones and to chloride of sodium. Hence the clays, the limestones, and the sea salt were the joint results of a process which was slowly removing from the earth its carbonic acid and fitting it for the support of higher forms of life. These views of Dr. Hunt, first put forward in 1858 and 1859, are gradually being received and appropriated by writers who do not always acknowledge the source of them. They are here insisted upon as preliminary to some considerations on the atmosphere of early lines, when it must have contained in the form of carbonic acid the whole or the greater part of the carbon now present in the limestone strata of the earth and in the beds of fossil coal.

Simple calculations show that the carbonic acid contained in a layer of pure carbonate of lime extending over the earth with a thickness of 8.31 meters, would, if set free, double the weight of our atmosphere, and that from 13.65 meters (about forty-four feet), would double its volume. It moreover appears that a similar layer of ordinary coal, one meter in thickness, would suffice to convert into carbonic acid the whole of the oxygen of the atmosphere, so that if, as is probable, the whole amount of coal and carbonaceous matters on the earth exceeds this quantity, there must have been an absorption of the oxygen, set free during the conversion of carbonic acid into coal, this oxygen being probably retained by peroxyd of iron. Disregarding this, however, and admitting that the carbonic acid, corresponding to a layer 8.61 meters of limestone (about twenty-eight feet) were present in our

atmosphere, the effect would be most remarkable. The height of the barometric column would be doubled, the boiling point of water raised to 121° centigrade (250° Fahr.), and as the absorptive power of an atmosphere of carbonic acid is, according to Tyndal, ninety times that of dry air, the temperature of the lower regions of the atmosphere would be greatly elevated, and the whole climatic conditions of the earth modified. Yet, as the amount of carbonic acid required to produce these results is probably but a small proportion of that now fixed in the limestones of the earth's crust, we should find this condition of things at a period geologically not very remote, and in still earlier times the earth must have had a far denser and more highly carbonated atmosphere than that just supposed. The relations of such a condition of things to the animal and vegetable world, furnish fruitful themes for conjecture and experiment; and its influence and chemical processes, is not less worthy of consideration, as a single instance will show. Some years since, I pointed out that the explanations of the almost constant association of gypsum and magnesian limestone in nature was to be found in the fact that solutions of bicarbonate of lime and sulphate of magnesia decompose each other with production of solutions of sulphate of lime and bicarbonate of magnesia. By spontaneous evaporation the former may be in part separated as gypsum, but as in this process the bicarbonate is changed into monio-carbonate of magnesia, this partially decomposes the gypsum, regenerating carbonate of lime, and the results of the experiment in an ordinary atmosphere are imperfect. I find, however, that by infusing into the drying atmosphere a large proportion of carbonic acid the separation by evaporation goes on regularly and the gypsum is deposited in a pure state, enabling us thus to realize the conditions of earlier geologic periods when vast beds of gypsum, with their accompanying magnesian limestones, were deposited in evaporating basins at the earth's surface beneath an atmosphere charged with carbonic acid.

Ebelman has speculated on the probable existence of a much larger proportion of carbonic acid in the atmosphere of earlier geologic times, and Dana, Tyndal, and anterior to them, the late Major E. B. Hunt, have considered its meteorological relations, but the chemical history of this carbonic acid, considered with reference to its origin, its fixation in the form of limestones, and its influence on chemical processes at the earth's surface, are points

for the most part peculiar to the author, and in part now brought forward for the first time.

The third paper, from the pen of Sterry Hunt, was

On the Source and Origin of Petroleum,

Of which we are able to give only a brief notice. The speaker adverted to the history of certain views relative to petroleum. He had shown in 1861, that the mineral oil of Western Canada was indigenous in the corniferous limestone, wells sunk in the outcrop of which have yielded, and still yield, oil in that region, and also in Kentucky, according to Leslie. At that time (1861) he called attention to the existence of petroleum in the limestones of the Trenton group, and had, since then, in the Geology of Canada, in 1863, insisted upon these Lower Silurian oils as likely to prove in some regions, of economic importance—a prediction verified by the recent developments in the Lower Silurian strata of the Cumberland, in Kentucky, and the oil wells of the Manitoulin Islands, which latter are sunk through the Utica and Trenton formation. Another important point on which he had been the first to insist, was that the accumulation giving rise to productive wells occur along the lines of anticlinal folds, where the oil would naturally accumulate in fissures or in porous strata, in obedience to well known hydrostatic laws. This view, first insisted upon in a lecture published in the *Medical Gazette*, for March, 1861, was further developed in a paper on petroleum in the *Canadian Naturalist* for July, 1861, and simultaneously by Prof. E. B. Andrews in *Silliman's Journal*. Since then this view, though frequently opposed, is gaining ground, and according to Prof. Andrews and Dr. Newberry, is sustained by all experience in the oil fields of the United States, as it also is in Canada. This remark applies to large accumulations and to flowing wells, but oil may doubtless flow slowly from horizontal strata containing it.

As to the origin of the petroleum, Dr. Hunt supposes that it is indigenous in the two limestone formations already mentioned, and that it may have from there risen and accumulated in overlaying previous strata, or in fissures capped or sealed by impervious beds, such as Pennsylvania sand rock, or quartenary gravel beds.

He is inclined to think, however, that petroleum may also be indigenous in certain sandstones of devonean or carboniferous age, and referred to Lesley's observations to this effect, closely

agreeing with those of Wall and Cruger in Trinidad, where fossil plants are sometimes found partly converted into petroleum and partly into lignite.

Dr. Hunt regards the process by which animal and vegetable hydrocarbonaceous tissues have been converted into solid or liquid bitument, as a decay or fermendation under conditions in which atmospheric oxygenation is excluded, so that the maximum amount of hydrogen is restrained by the carbon ; and as representing one extreme of a process, the other of which is found in anthracite and mineral charcoal, the two conditions being antagonistic and excluding each other, and the production of petroleum implying, when complete, the disappearance of the organic tissue. Hence pyroschists, the so-called bituminous shales, and coal are not found together with petroleum, but in separate formations, and it is to be borne in mind that the epithet bituminous, applied to the former bodies is a mistaken one, since they seldom or never contain any bitumen, although like all fixed organic bodies, they yield hydrocarbons by destructive distillation. The fallacy of the notion which ascribes petroleum to the action of subterranean heat on strata holding coal and pyrochists, was exposed, and it was remarked among arguments founded upon the impermability of many of the petroleum-bearing strata, that the oil of the Trenton limestone occurs below the horizon of any pyroschists or other hydrocarboneous rocks.

Among improvements proposed and new inventions described, may be mentioned, first, the paper by President Barnard describing

A New Method of Illuminating Opaque objects under powers of the Microscope.

The author after explaining that when powers are used the distance to the object to be magnified was so small it was found almost impossible to illuminate. The means now used for illuminating is the Lueberkuehr mirror—a highly polished conical plate. The author made a series of explanations with this mirror, placing it inside the tube above the lowest object glass and arranging it so that the light will pass to the mirror and then down upon the object. In order to fully carry out his idea it was necessary to grind the lower or plano-convex lens in a new way.

Prof. Perkins, of Union College, after speaking favorably of the improvements described, proposed to perforate the shoulder of the main tube at the place where the object glass tube is screwed

in, this perforation is covered with a diaphram when not in use. Above this he places the conical mirror, the light from the mirror below being sent up to the conical mirror and from thence to the object below. He believes cloudiness will thus be obviated.

Dr. Barnard thought the suggestion valuable, and stated he was still experimenting in that direction.

Dearborn Observatory at Chicago.

Prof. T. H. Safford, director of the Chicago Observatory, gave an interesting account of that new institution and the great instrument of which it boasts. The Observatory originated in a movement started some years ago by Prof. Forey, who gave a series of lectures on astronomy in Chicago, and proposed to the citizens the purchase of a telescope of Mr. Henry Fitz. A committee was appointed to raise subscriptions for the purpose, and Hon. J. Y. Scammon offered the means for the erection of the necessary buildings. A committee was also appointed to investigate the subject of telescopes, and the committee determined not to purchase the instrument of Mr. Fitz, but to obtain, if possible, that being constructed by Mr. Clarke, of Cambridge, Mass., which had been ordered by President Barnard for the University of Mississippi, but which was lost to its original purchasers by the occurrence of the war. The object-glass for this instrument is the largest in existence—18½ inches in diameter. It was procured with some difficulty, and the building to receive it was commenced, and was completed last March. It is built of the limestone common in Chicago, and is situated at the southern extremity of the city. The diameter of the tower is thirty feet, its height ninety-six feet, which is favorable to observations, owing to the greater stillness of the atmosphere. The object-glass of the telescope is of first-class excellence, so that full advantage is got of the aperture. The focal distance of the glass is twenty-three feet.

The subject of observation, with which the Professor has chiefly occupied himself since the telescope was mounted, has been that of the nebulæ. He briefly gave an interesting account of these observations, suggesting the question whether the immense number of the nebulæ found near the pole of the milky way is not connected with the number of the stars in the milky way. He has found thirty-seven new nebulæ not catalogued by Herschell, and notices that many of those described by Herschell as very faint appear but slightly faint, showing that the Chicago instrument has greater optical power.

He announced in conclusion that a very perfect meridian circle has been ordered for the Observatory from Germany.

Prof. Hough of the Dudley Observatory, described the beautiful self-recording barometer invented by him, and first exhibited in public at the last fair of the American institute, a full description of which will be found in the Transactions of the Institute for 1865–6.

The description of this instrument elicited considerable discussion, from which it was evident that some of the savans present had not appreciated the importance of Prof. Hough's improvements, and did not foresee the entire revolution which must soon occur in the method of making meteorological observations.

Dr. L. Bradley, of Jersey City, read papers on "The Anthistometer," "The electro-magnet" and "The galvanic battery," all of which had in substance been previously presented before this Association.

The new chemical nomenclature, first explained by me before this Association in May last, was also the subject of a long paper.

One or two other novelties were presented, which I had no opportunity of examining.

The effect of water, in modifying the temperature of the air, is set forth in the following summary:

The Fruit-Producing Belt of Michigan. By Professor A. Winchell.

This paper was an exposition of the influence of Lake Michigan upon the climate of the belt of country lying along its eastern shore, and extending about forty miles inland, and embraced a statement of the effect which this influence has upon the agricultural and horticultural adaptations and capabilities of that region. Lake Michigan is a body of water 350 miles long, 75 miles broad and 900 feet deep. This enormous mass of water never attains an elevation of temperature greater than 45 or 50 degrees, and never sinks below 35 or 40 degrees. It consequently exerts a powerful influence in moderating the rigor of both winter and summer. Since our prevailing winds are from the west, this influence is principally felt upon the Michigan shore.

In order to determine definitely the extent of this influence comparisons have been made by Prof. Winchell, between the results of meteorological observations kept on the eastern shore of the lake, and at various other localities in the same latitude from Maine to Minnesota. These comparisons show that the mean

temperature of the wintry months at Traverse City, at the head of Grand Traverse Bay, is from seven to twelve degrees higher than at Manitowoc, Wis.; Hazzlewood, Minn.; Gardiner, Me., and Montreal C. E.; and from one to three degrees higher than that of places in the latitude of Janesville, Dubuque and Ann Arbor.

In the next place it was shown that the *average* minimum range of the thermometer is from thirteen to twenty-four degrees higher than at the other places in the same latitute, and from one to seventeen degrees higher than at other places two or three degrees of latitude further south.

Finally, it was shown that the *extreme* minimum reached by the thermometer of Traverse City is from thirteen to twenty-eight degrees higher than at other localities in the same latitude—showing a complete exemption from those extremes of winter weather which prove so destructive to fruit trees.

The Grand Traverse region is peculiarly protected both by the expanse of Grand Traverse Bay and by the curvature of the lake, which is such that southwest winds—generally the most severe in this region—have to pass over a considerably greater extent of water surface that the same winds in reaching the St. Joseph region near the southern extremity of the lake.

As the soil along this belt of country, a very short distance back from the shore, is generally of excellent quality, the peculiar influence of the climate develops and perfects crops of delicate fruits which cannot be raised on the opposite shore of the lake, nor even in the central and eastern portion of the State.

The St. Joseph region has for several years been known as producing peaches in the greatest perfection, and it is now becoming known that the same capability is possessed by the entire belt of country under consideration and to as great an extent in the Grand Traverse region as in any other portion of the belt. For settlement no portion of the northwest offers greater inducements than this region, a full description of which is embraced in a late report on the Grand Traverse region by Prof. Winchell.

Two papers were presented by Prof. E. N. Horsford. The first was

On the effects of Alum in making Bread.

The use of alum to improve the appearance of bread made from an inferior flour, is in early date in Belgium, France and England, and its employment for this purpose has been prohibited under severe penalties.

Notwithstanding parliamentary and municipal acts, which, in Paris, for a second offence, deprives the baker of his license, it is still frequently found in the cheaper forms of bread. Its effect is to stiffen the gluten, which has been impaired by growing, sweating, heating or souring—and so produce a factitious whiter and more porous loaf than would be possible with the poor flour in the ordinary process of making bread.

Among the deleterious qualities when swallowed with food, ascribed to alum, Leibig mentions its withdrawal of phosphoric acid, forming a phosphate of alumina—and so rendering useless a certain amount of an important agent of nutrition.

Orphea and Mitschertich observed its deleterious effects on animal life. Fatal effects upon human life have been noticed in England and in this country. A physician of New York recently lost a child from the accidental use of alum, when borax had been prescribed.

It has been suggested that if alum was mixed with flour and alkali enough to neutralize the sulphuric acid added, it would yield a neutral prescription which would become an inert powder. In order that this might be true, alumina must be insoluble in the gestric juice which is an acid fluid.

The acid reaction was early ascribed by Prout to free hydrochloric acid. He had found that by evaporation of the gastric juice to dryness, and subjecting the residue to the distillation, he obtained in the distillation, an acid which gave a precipitate with nitrate of silver, soluble in ammonia, and insoluble in nitric acid; and concluded that the acid reaction was due to hydrochloric acid.

Later observers, finding lactic acid present in the gastric juice, gave a juster interpretation to the phenomenon. Lactic acid being non-volatile, while hydrochloric acid is volatile, would, in the presence of chlorides, upon evaporation and distillation, drive out hydrochloric acid, leaving lactates in the place of the chlorides. The discovery of traces or other organic acids led to the opinion that they might share in the cause of the acid reaction.

More recent observers, recognizing the presence of acid phosphate of lime in the gastric juice, attributed to this body the acid reaction. This body would, of course, be present where phosphates and lactic acid, or other organic acids come together, and would yield the reaction observed by Prout.

The acid phosphates of lime, on the application of heat, would

expel hydrochloric acid from chlorides. No one would, probably, be now found to urge strenuously the view entertained by Prout; but, if there be, or if there might be, by any possibility, hydrochloric acid present in the gastric juice, it would not more certainly dissolve hydrobe of alumina than either acid phosphate of lime or lactic acid. All the lactates are well known to the soluble, and, of course, alumina would be taken up by lactic acid. The acid phosphate of lime would dissolve hydrobe of alumina, until the lime and alumina together gave the proportions of a neutral phosphate. To ascertain whether the alumina from these solutions acted like the solution of common alum, or of the solution of alumina in hydrochloric, Prof. H. made these experiments: He added hydrate of alumina, with agitation to a moderately diluted solution of acid phosphate of lime, until it began to be turbid. He then filtered the liquor, added more water, and poured a few drops into a solution of white of egg. In a short time it began to whiten and coagulate, and after a few hours was thoroughly gelatinized. He made a saturated solution of lactate of alumina, diluted it moderately with water, and added a few drops to solution of white of egg.

The hydroclorate of alumina similarly treated was added to solution of white of egg. The same changes took place with both the latter that had taken place with the former. A stiff coagulum was formed in all three vessels, and all might be reversed with spilling.

Neither the diluted acid phosphate of lime, nor the diluted lactic acid produced any effect of coagulation on the solution of white of egg employed.

The experiments show what must be the effect of soluble alumina on reacting the blood through the lacteals. It there finds a collision of bodies allied to white of egg. Albumenoid substances, on their way to various parts of the organism, and in process of transformation to become suited to special composition.

In order to change these transformations forces are brought into play into certain constant, normal, chemical and physical conditions. Compounds are elaborated of higher and more complete constitution, as for example, the muscular and cerebral system. This elaboration requires freedom of motion among the particles. Whatever obstructs or restrains this, interferes with and degrades assimilation.

Now the properties of alumina are well known. It is the great

mordant. In calico printing it fixes the colors with which it combines, and renders them comparatively imperishable. It is employed to preserve size—a gelatinous body, prone to decay. It is used to keep hides from spoiling. In short, it is an agent which, when it combines with albumenic substances, render them relatively insusceptible of chemical change. Such a body, in solution in the blood, would combine with the albumenic substances all the more readily from the alkaline character of the fluid—which, freeing the alumina from the air, would precipitate it upon the albumenoid compound. These bodies, fallen within the grasp of the alumina, would be incapable of further change, and their office in assimilation impaired, if not at an end.

Beside the effect of alumina in withdrawing phosphoric acid from the stores of nutrition received with it into the alimentary canal, and deleterious effects on assimilation, when received into the stomach either as alum or as hydrate of alumina, there is the better known effect upon the mucous membrane of shriveling, which is accompanied by constriction of the capillaries, congestion and sometime by inflammation. In fatal experiments made upon animals, the mucous membrane has been found extremely inflamed.

In view of these effects of alum, it is obviously wise to leave the use of such an agent in the counsel of educated physicians.

The Effect of Sunshine on Fire, by Prof. E. N. Hosrford.

Professor Horsford commenced by alluding to the popular notion that sunshine deadens fires; mentioning that the fires in grates in rooms having southern exposures, burn briskly in the early part of the day, slacken before noon, and revive again towards sunset. Stoves and ranges that bake well in the autumn, winter, and spring, fulfill their office but indifferently in the middle of the day in the height of summer. Some furnaces in which iron is generally smelted without difficulty, cannot, in very hot terms, be brought to a working heat. While the popular mind ascribes these effects to some agency of the sun, scientific men are disposed to regard the effects as rather apparent than real.

The first recorded research bearing upon the subject was made as long ago as 1825, by Dr. Thomas McKeever, who found, as he conceived, the popular impression sustained. In his experiments a given weight of wax taper was consumed quicker in the dark than when exposed to the sun. A given length of candle required less time for combustion in the dark than in the sunshine. A given

weight burned quicker in a painted lantern than in an uncoated lantern, both alike exposed to the sun.

These experiments did not find acceptance with Gmelin, and did not appear in the original Handbook of Chemistry, doubtless from a conviction that some error must have occurred either in the method or record of observation. Nevertheless, Dr. McKeever's experiments appear as additions in the Cavendish Society's translations of the Handbook. The summary of his results may be stated thus: It required eleven minutes to burn in the sunshine the same weight of candle that burned in the dark in ten minutes.

Similar experiments were made at a later period by Dr. Morrill Wyman, of Cambridge, and reported to the American Academy of Arts and Sciences. The result at which he arrived was exactly the reverse of that reached by Dr. McKeever. He burned two sperm candles, each alternately for half an hour in the sunshine and in darkness, and found the candle during its exposure to sunshine burned more rapidly than when in the dark.

In 1856, the subject was taken up by Prof. Joseph Le Conte, of Columbia, S. C. He concentrated, with the aid of a reflector and a burning glass, the sun's rays upon the *flame only* of a wax (sperm) candle in a large dark room. At the same time another candle was burning in the same room, under identical circumstances, except that the flame was not exposed to the sun's rays. The result showed that the effect of the sun's rays, though greatly exaggerated by concentration, when confined to the flame, did not appreciably increase the consumption of tallow.

Here then we have apparently all possible results of experiment; to wit: sunshine diminishing the rate of combustion as observed by Dr. McKeever, augmenting the rate as observed by Dr. Wyman, and producing upon it no effect whatever as shown by Prof. Le Conte.

Dr. McKeever ascribed the retardation to some peculiar effect, as of interference of the solar ray upon flame.

Dr. Wyman inferred that the sunshine by warming the tallow of the candle exposed to it, facilitated its melting and by so much spared for destructive distillation and combustion, the heat of the flame, which would have otherwise, in larger measure, gone to liquify the tallow.

Le Conte conclusively showed that when the column of wax or tallow is sheltered and the sunshine directed solely on the flame,

the effect on the consumption of the tallow is too small to be recognized.

The observations of the later experimenters agree in throwing doubt upon the interpreation which Dr. McKeever gave of his own experiments.

Prof. Horsford then proceeded to detail a series of experiments he had made, showing the probable source of error in Dr. McKeever's investigation. He ascribes it to the incidental greater flaring of the candle in the dark. The experiments with the lanterns he explained by the well known effect of dark paint in absorbing radiant heat, and converting it into heat of conduction, by which the air in the painted glass lantern was more heated than in the lantern that was not painted.

Prof. Horsford then gave an account of the diminished draft in the range flue of his dwelling house during the recent hot term, which rendered it impossible to bake meats or bread in the oven of his range. This continues from eleven o'clock to about three, within which hours bread could not be baked. With the decline of the sun in the afternoon, as in the early morning, the oven performed its office better.

The chimney was fifty-four feet high. The roof of the house was of dark slate. It was all exposed to heat at about eleven. Some of it began to pass into shade at about three.

In the effect of this greater exposure to the sun, during the hours when the sun was highest, Prof. Horsford found the explanation of the observed phenomanon. The heated top and sides of the house warmed the air in contact, giving rise to an upmoving column from the top of the house, and to an endless shroud of air sweeping up the sides of the house. This ascending shroud by friction draws the air from the cracks, doors and windows, of the house, lessening the pressure of the air in the interior, and of course diminishing the draft.

After showing the applicability of this explanation to the various cases that occur with dwellings, iron furnaces, &c., the paper concluded with the following summary:

First. That sunshine falling on the flame only of a burning body does not affect its rate of combustion.

Second. That other things being equal, neither light nor darkness exert appreciable influence on the rate of combustion.

Third. That other things being equal, two samples of the same

combustible, one burning in sunshine will consume more rapidly than one burning in darkness.

Fourth. That combustion during the winter is more vigorous than in summer, because a given volume of air contains more oxygen, is denser and dryer.

Fifth. That slight currents by causing a flame to flare and come in contact with more air in a given time, causes more rapid combustion, and by presenting greater surface from which radiant heat issues to warm the combustible about to be burned, increases the rate of combustion.

Sixth. That the diminished draft of chimneys in very hot weather when the general atmosphere is at rest, and the sunshine intense, is due to upward currents on the outside of the house, arising from the heated surfaces of the roof and walls, which currents by friction draw outward through cracks and open doors and windows the air from the interior of the house, and so lessen the pressure within and overcome the draft of the chimney.

Seventh. That the popular impression that intense sunshine lessens the draft of chimneys, is founded in fact.

The first regular business before the Polytechnic was the examination of new inventions and discoveries.

New Earth-Pulverizer.

This machine, the invention of Messrs. Fithian Young, was exhibited in model. It consists of a series of rotary cutters so shaped and combined as to act on the soil in a nearly uniform manner, while the whole machine has a forward movement. Motion is communicated to the cutters by a large wheel having on its periphery a double row of slats forming a very obtuse angle at their points of contact, the effect of which is to take a firm hold of the earth whatever may be its condition. The whole is mounted on four wheels, which are brought into use only when it is being moved to and from the field.

As this is a new attempt to solve a question of the greatest importance—the proper method for preparing the ground for seed—the machine was subjected to the closest scrutiny of several mechanicians present. Its construction was admitted to be ingenious, but its practical value can only be determined by repeated tests. Fields of the same dimensions and prepared for the same kind of seed by the plow and harrow, and by this new machine, would by their yield show precisely the advantages secured by

the new plan. This machine was also shown at a meeting of the Farmers' Club, and special report was made thereon.

Messrs. Maynard and O'Reilly alluded to other rotary diggers now in successful operation.

Mr. E. Stevens said it had been found profitable to plow land several times before planting; the use of the spade was admitted to be most efficient in preparing the soil. As far as pulverizing and aerating the soil was concerned, it seemed to him the plan now presented would be more effectual than any of the old modes. After some queries by Mr. H. F. Walling had been answered, the Secretary, Mr. T. D. Stetson, took the floor, and examined in detail the novelties embraced in this machine, and concluded by urging its manufacturers to make early and repeated trials of it in order to be able to state definitely how much benefit the farmer is to derive from this new mode of culture.

New Valve for Steam Engines.

Dr. Warren Rowell remarked he had some years since invented a perfectly balanced rotary valve, which was now public property. He had lately changed the form of the valve so as to adapt it to the common locomotive. The model exhibited will show it is so arranged that the pressure of steam is evenly distributed upon every side, thereby overcoming the serious objections brought against the valve in common use.

New Mode of Communicating Power.

Dr. Rowell also exhibited two models of plans for transmitting power to distant points. The first he contrived during the summer vacation, and had presented to the public through *The Scientific American*, and he noticed the *London Mechanics' Magazine* had copied the drawing and description of it, giving him due credit. He wished to say that substantially the same thing is found on all locomotives where four driving-wheels are used, for in this case double cranks at right angles are connected by rods, but being on opposite sides of the machine this relation is not noticed. He had now another plan, which he claimed was entirely original. The model exhibited shows three rods forming a triangle; at each angle there is a crank on which two of the rods play. It will be seen that by revolving crank No. 1 motion is communicated direct to crank No. 3, and at the same time, in a round-about way, through crank No. 2, and thus pressure is brought to bear on crank

No. 3 from two directions at the same time, thus obviating the dead-points which occur when power is applied to a crank in one right line. The description of this novelty was received with a round of applause.

The chairman remarked: So much ingenuity has heretofore been expended in gearing and motor connections that we seldom meet with anything new. The last invention of Dr. Rowell deserves our commendation. The first was only a modification of that found in the books, for, as will be seen by an illustration on the black-board, by having three cranks on the same axis, motion may be communicated to three similar cranks of another shaft at a distance by merely connecting the like parts by a rope or wire, because the power can be constantly communicated by drawing, and not by pushing, as will be necessary where only two connections are made.

Mr. T. D. Stetson said this experiment was made on a large scale at Niagara, where power was communicated by means of four cranks to other four cranks, at a distance of two hundred and fifty feet. It was found, however, that the sag and stretch of the wire-ropes used in this instance, being of course expanded and contracted by changes of temperature, were so great that the apparatus proved a failure. For short distances such connections may be efficient.

Mr. L. B. Page said the beautiful arrangement of Dr. Rowell reminded him of a connection of a different kind used in the oil regions. He knew an instance where one steam engine of forty horse-power worked about twenty oil pumps, and the connections of timber producing a reciprocating but no rotary motion, were not less than *a mile and a half long.* He promised to present before the Association, at a future meeting, a drawing of that novel arrangement.

Ventilation.

This subject, selected for discussion, was first taken up by Dr. Rowell, who averred that all drafts through doors, windows, ventilators and chimneys, depended on the different degrees of rarefaction of the air. The highest air ascends because it is displaced by air of greater density. The whole action is, therefore, the result of gravitation. In order to make this clearly understood, he had prepared a little apparatus which could be copied by young experimenters in natural philosophy. It consists of a glass beaker, which is to be partly filled with water; a glass tube with

a funnel at its top is inserted in the beaker nearly to the bottom. A vial containing a few shot, to make its specific gravity the same as that of fresh water, is tightly corked, and when placed in the beaker barely floats just beneath the surface of the water. Now by pressing in the cork slightly the size of this little glass boat is made smaller, while its weight remains the same; yet its relation to the water is changed because it is heavier than an equal volume of water, and therefore it must sink to the bottom of the beaker. Water, saturated with salt, is now poured through the glass tube, and, having a greater specific gravity than the fresh water and the little vial, it finds the lowest level in the beaker displacing the fresh water and at the same time raising the vial, which now floats midway in the beaker and on the line between the salt and fresh water. This little experiment illustrates the action of a baloon which does not rise of itself, but is pushed up by the heavier air which is constantly displacing it. The difference in temperature affecting density being then the cause of all motions of the air, he had been inclined to believe it had more to do with the process of breathing than was generally supposed. During the late heated term he had observed many sickly children still in the nurse's arms breathed with great difficulty. He thought when the difference between the temperature of the air and that of the lungs was greater, nature assisted the weak child in the process of breathing.

Dr. L. Bradley did not accept this doctrine. The action of the lungs belong to the class of involuntary motions, but the strength to move the lungs was a force generated in the body by means of food.

Dr. J. B. Rich said there was something in the position taken by Dr. Rowell: the involuntary action of the lungs did not do the whole work; the coldness of the inhaled air and the warmth of the exhaled air materially effected the action of breathing. The process required time. He had found when he had charge of the physical training of many persons that with the aid of the voluntary muscle the process of breathing could not be carried on with great rapidity for any length of time.

The chairman said, with regard to ventilation, much that is important remains untold. The law of the diffusion of gases is a higher law than that of gravitation in some instances. This matter had been generally overlooked by inventors of ventilators. He intended to say more on this subject at the next meeting.

Frequent allusions having been made to the draft of chimneys, he proposed to illustrate, on the black-board, the composition of the air as it entered the furnace, and the relative quantity of oxygen and nitrogen it contained, together with the volume and composition of the products of combustion. The element nitrogen takes no active part in the process of combustion; it, however, becomes highly heated, and thus rarefied and mixed with carbonic acid, and sometimes carbonic oxyd, assists in bearing rapidly away the gases resulting from the process of burning.

Several other gentlemen participated in the debate, which is to be renewed at the meeting on Thursday evening, September 20, and to that time the Association adjourned.

AMERICAN INSTITUTE POLYTECHNIC ASSOCIATION,
September 20th, 1867.

Prof. S. D. Tillman, Chairman; Mr. T. D. Stetson, Sec'y.

The chairman read the following letter addressed to the President of the Institute:

UTILIZATION OF GAS HOUSE LIME.

NO. 8 PINE STREET, NEW YORK,
August 27th, 1866.

Hon. HORACE GREELEY, *President of the American Institute:*

Sir—The editors of the *Mining & Petroleum Standard and American Gas-Light Journal* have called to my notice a report of proceedings of the Farmers' Club of the Institute, wherein some information was asked relative to the treatment of gas house lime. As the question implies a wider scope than expressed in the report, and having bestowed some attention to this speciality, and with, I consider, satisfactory results, I respectfully submit what follows, for whom it may concern.

As lime is known to be the cheapest and most convenient substance yet discovered for purifying commercial gas, it follows that the purer the limestone from which it is made, the better will be the result. It is used in a wet or liquid state, as milk of lime, in many cases, but in this country is usually employed as hydrated or water slacked, in nearly a dry condition; shell lime is also used to a great extent in New York.

The lime is laid about three inches deep upon wooden seives or

trays, of convenient size for handling, which are placed in iron purifying chests in layers or stages, with intermediate spaces, until the chest is filled, and which is finally shut by a closely fitting water sealed cover. The gas, admitted at the bottom of the chest, is made to permeate and pass through the lime, which in the transit, absorbs sulphuretted hydrogen, carbonic acid, and other impurities from the gas which passes out at the top of the chest.

After the lime has done its work, or become surcharged with impurities—as is generally the case—the gas is shut off from that and turned on to a chest having a fresh supply of lime. The contents of the first chest have now to be removed, which, until recently, was accomplished in the following manner by all the gas-works in this city:

The cover of the chest being removed, the seives are one by one taken out and emptied either into a barrow by which the lime is trundled off to a waste heap, or is thrown in a pile and afterwards removed to the deposit heap, usually upon or adjacent to a wharf. Now, as this surcharged lime has a great affinity for air, it absorbs it rapidly as soon as exposed, and hence becomes quite hot. The heat disengages the gases. which are thereby evolved into the air, greatly to the inconvenience—if with no other ill effect—of all persons in the neighborhood, and often those a long distance away. The lime thus treated becomes inodorous after a few hours, and is used, in some cases, to fill in waste ground, in others is sold at trifling rates for use upon land or mixed with fertilizers, with, I consider, very questionable utility.

The noxious odors from gas works, of which there has been so long and such frequent complaint in this city, arise almost exclusively from the causes here given; all other offensive smells are either insignificant, or controllable with proper care by the means long used by the companies.

The recent action of the board of health upon the "gas house nuisance" has induced an improvement by the very distinguished engineer of the Manhattan Gas Co., who deserves the gratitude of the complainants for a clever practical device, to at least mitigate the evil under peculiar emergencies. The action of the board (so properly potent) was almost mandatory; its imperative commands were slightly modified upon a promise to experimentalize. Chemistry, after various trials, failed to meet the issue with present arrangements; it was impractical to undertake extensive

changes in the works, or to remove them. There seemed but one alternative, if the board insisted, and that was—stop the works, shut down the gate, and, of course, stop the supply (of gas). But that would be a greater evil than the odors. The health officers were getting firm and impatient, when Mr. Sabatton circumvented the whole procedure by a little practical strategy.

Instead of opening the chest and exposing its contents to the air, to set free a stench which some one might say could be cut with a dull knife, he forces through the chest a powerful current of air, its exit being carried some distance away from, and to a higher level than the works. The result is to so dilute the offensive gases with air that the objectionable effects are scarcely noticed by former complainants; but it is questionable if the real evil, if one of a sanitary type exists, is more than mitigated. An advantage realized to the gas companies by this plan is, that the lime may be used over and over, it is said, several times, before removal, and, at least when taken out, is not offensive.

I have no doubt that if differently treated than it has hitherto been, the waste lime from gas works may be vastly economized and converted into a valuable fertilizer, particularly for certain soils, and by the same means attain a quite as satisfactory sanitary result as that I have described.

I propose to pulverize or granulate dry peaty matter—which, in that state, rapidly absorbs and fastens sulphuretted hydrogen and other feted gases in great volume. Provide upon wheels boxes of about one cubic yard content, and arranged to be easily emptied; one of which boxes fill with the prepared peaty matter, and place one or more of each alongside of the purifying chest. The chest being opened, empty the contents seive by seive into the empty box, an attendant standing by the peat and throwing over the lime from each seive about an equal quantity of the peat, until the box is full, when it is removed to the place of deposit, and another substituted in its stead.

The work of opening the chest and removing its contents should be as expeditious as possible, for which reason it will be well if the chest be so placed that it can be worked on each of its four sides.

To render this process complete and most efficient, a grinding mill should be used convenient to the works, and to which mill the mixture should be conveyed in the boxes and dumped over the hopper. The mill is for the purpose of thoroughly and

quickly incorporating the lime in uniform fineness by breaking up all lumps. From the mill the mixture should be placed in barrels and headed up for sale.

By this operation there will be a very slight escape of gas, and then for only a brief interval, and a valuable mixture is obtained, which will not only serve in a great degree to meet the expense of the lime to the gas companies, but will preserve for agricultural use a valuable commodity now absolutely wasted.

Very respectfully, your obedient servant,

J. BURROWS HYDE.

Mr. Geo. Bartlett remarked that a recent number of the *London Gaslight Journal* had a communication from the superintendent of one of the gas houses there, in which it was stated that while the cholera was there none of the employees were attacked with it, and they used to bring their families to sleep in the gas house while it was raging there. It was now, Mr. B. thought, well settled, that foul odors are not unfavorable to health. The gases in themselves are not injurious. It is probable that these simple deodorizers are not of much use in preventing the spread of the disease.

Dyed Wood.

The chairman then exhibited a number of beautiful specimens of dyed wood presented by Barton H. Jenks, Esq., of Bridesburg, Pa., and read the following letter regarding them addressed to the President:

Bridesburg, *August* 20, 1866.

Hon. Horace Greeley, *President American Institute :*

Dear Sir—I have the honor of sending to you, directed to the rooms of the Institute, samples of dyed wood. Two sides of the samples are varnished; the other two sides left as they appear taken from dye. Each sample is marked with the kind of dye used, and there are duplicates of each dye, one with and the other without, paraffin. The invention relates to a new process for ornamenting various kinds of cheap woods, and imitating the more valuable varieties of wood for the purpose of producing a new article of commerce which will be valuable in the manufacture of furniture and all other purposes where ornamental woods are required.

The invention consists in imparting permanent colors to different kinds of wood, by first expelling the air and gases from the

spiracles or pores of the wood, and then injecting into these void places or spaces, any suitable coloring matter which will thus permeate every pore and strike through the body of the wood, by which means lumber in the rough can be colored to imitate the beautiful woods and afterwards wrought in the various forms required.

The apparatus consists in having a strong vessel similar to a steam boiler, with a large door through which the wood to be treated is put into the vessel. This opening should be closed air-tight after the wood has been put into the vessel. The air is then exhausted from the vessel by means of a powerful air-pump, until the air has been expelled or drawn from the spiracles or pores of the wood. The coloring matter in solution in then introduced in the vessel which will permeate the substance of the wood and fill the spaces made vacant by the exhausting process. The wood can then be removed from the vessel and properly dried, or the vessel can again be exhausted by the pump removing the coloring matter, and any dampness that may be in the wood, and then it is ready for the market.

All the well known dyes and analine colors can be used which will give the greatest permanancy of color.

If desired, various colors may be used in the same piece of wood, and at the same time, so as to dye the piece in a variegated manner throughout its substance.

This process will also deprive the wood—which has not been thoroughly seasoned—of gummy juices, and allow the coloring solution to fill their places.

This invention is applicable to the dying of other vegetable substances, and also to the dying of animal substances, such as woolen cloths, leather, &c.

I have discovered that the woods of my experiments contain 800 to 1,000 times their volume of air and gases.

The experiments have been made on blocks of wood twelve inches long and five inches square, from which I have cut off the samples sent you.

I am erecting works to dye timber twelve inches square and eight feet long, to be used in my business, but for commerce, works should have a capacity for taking in much larger pieces of timber.

I desire the matter may be brought before your Institute, as it

is a new enterprise, a new article of commerce, and an advance in the arts and sciences.

Respectfully,

Yours truly,

BARTON H. JENKS.

P. S.—All the samples, sent you, are of pine wood, costing \$55 per 1,000 feet; and the cost of dyeing (excepting the six aniline colors), \$10 per 1,000 feet. The cost of the six aniline colors are much more, being alcohol dyes—all the others are water dyes. The wood is perfectly dried, after being dyed, by the exhausting or vacuum process, before being removed from the receiver.

I am experimenting with various hard woods, such as maple, ash, dogwood, &c., and will send you samples of these woods also.

B. H. J.

The reading of this letter and the examination of the accompanying specimens drew out the following remarks:

Mr. T. D. Stetson said there was an immense difference in the adaptability of articles to take dyes. The specimens here shown, although very fine, seem to prove that wood does not take brilliant colors.

Dr. Stevens said he had seen whitewood and pine dyed the most brilliant colors.

Mr. I. R. Hudson remarked that he had seen some very brilliant whitewood, colored through, and of a very rich color, made in Centre street, in this city.

Mr. S. H. Maynard said he had seen the wood of the apple and pear tree stained thoroughly through, but they are almost useless for the purposes for which the finer kind of woods are used, as they are soft and easily dented.

Dr. R. Rowell stated that some of the partitions of the Crystal Palace were made of pine wood, simply varnished over, and they looked very fine. He had seen furniture made of chestnut wood, and it had a splendid appearance.

Dr. J. W. Richards said that black walnut was once considered a useless wood, but now it is very valuable—a log of it is worth more than one of mahogany.

Mr. Stevens stated that large quantities of maple wood are sent from here to Europe every year.

Leather Shoes with Wooden Soles.

Mr. George May Powell exhibited a pair of leather shoes, having wooden soles, made in this city. The best feature was their dryness; they were well adapted to muddy streets.

Mr. T. D. Stetson said these shoes reminded him of what he saw on the other side of the Atlantic. He was surprised to find so many people wearing wooden shoes in the North of England. It seemed to him they could be heard a quarter of a mile off when walking on floors or pavements.

Mr. Maddock remarked that it was customary in England to partly cover the wooden shoe with leather; a wooden sole with a leather upper was quite common.

The chairman said the shoe now exhibited is very different from the wooden shoe or the leather shoe with wooden sole worn in England. It will be observed that this is like an ordinary leather shoe, with two additions of wood, namely: a wooden heal and a wooden tap. This arrangement allows the sole to bend as the foot bends. It is light, and it appears to be useful for farm hands who have to pass over plowed ground. A shoe with a thick sole is preferable to an India rubber shoe, covering one of leather. Some time ago India rubber boots were worn, but it was found they kept the feet continually moist from their perspiration. India rubber overshoes are now made with ribs or creases inside, which allow the perspiration to pass off. As many persons will wear thin shoes and boots, the rubber overshoe is best adapted for their use.

Ventilation.

The selected subject was brought up by the Chairman, who said that all attempts to carry off certain portions of the air of a room, which were supposed to contain vitiated air, were founded on a wrong impression regarding the separation of gases by their different densities. In this case, the law of diffusion was superior to the law of gravity—hydrogen will not remain at the top, and carbonic acid at the bottom of a room. The molecules of the same gas are constantly repelled. The carbonic acid gas rises, and the hydrogen descends, until they are equally distributed; but the hydrogen is diffused five times as fast as the carbonic acid. The rapidity with which gases intermingle, is inversely as the square root of their densities. Carbonic acid may be poured from one glass into another, because it is heavier than common air, but

if left so that it can escape, it will soon be equally diffused, if the amount is not large. In deep wells, containing this gas, this law does not hold good ; it may be, however, that the gas is supplied faster than it can be carried off.

The only true method of ventilation is, to continually carry off all the air of a room, and constantly supply it with fresh air. The importance of this subject is being realized by our public officers. Congress lately appropriated more than $100,000 to ventilate the Capitol.

Mr T. D. Stetson remarked, that to properly ventilate a room is a matter of some difficulty. The air should not come in so as to blow upon a person's head or neck. It is very well to open doors and windows for a robust person, but there are those to whom it would be decidedly injurious. It is difficult to get air into a room without incommoding any one. Where the top of the window is lowered, a comparatively solid body of air comes in, and mingles with the heated air only to a limited extent ; by dividing up this column of air, the mixing would be much accelerated, while no decided current would be produced. To accomplish this, he proposed to insert into the upper window sash a number of small tubes connecting with the air outside.

Dr. J. W. Richards said, the thermometer is now much more relied on than the ear to detect diseases of the lungs. So many persons dying from what is called sun-stroke were never known here as during the past summer, but numbers of persons have died who were not in the sun, and have kept in the shade. Persons who have small development of the chest are those who are most likely to die from the excessive heat. A very high medical authority has recently published a work on the impurities of the atmosphere, and he has very clearly shown the amount of contamination in a thousand cubic feet of air. There is a much greater amount of air required to ventilate a room occupied by a sick than by a healthy person.

The Association voted to continue this subject. Adjourned.

AMERICAN INSTITUTE POLYTECHNIC ASSOCIATION,
September 27th, 1866.

Prof. S. D. Tillman in the chair; Mr. T. D. Stetson, Secretary.

PEDOMETER.

Mr. H. W. Walling exhibited a pedometer for counting the number of steps made by a person in walking any distance. The inventor is Mr. A. F. Weatherby, of Dedham, Mass. This instrument would count up to ten thousand steps. It has a cord connected with the leg, which acts on a ratchet wheel, and thus moves the counting wheel the distance of one cog at each step taken. It is very light, and may be worn without inconvenience.

IMPROVED CAR.

Mr. Taylor exhibited a model of his street car, designed to transfer the traction from the ground to the metallic bottom of the car, which thus takes the place of the rail. The wheels are mounted on a number of pedestals, attached to an endless band, encircling the car.

The chairman said that this is, perhaps, the best application of the old principle of a portable track that has been invented, but its practical value remains to be tested.

MEASURING FUNNEL.

Mr. Campbell exhibited Whitney's measuring funnel. A graduated plate of glass fitted in the side of the funnel serves to indicate the quantity of fluid in it, a faucet at the bottom preventing the fluid from falling out.

Dr. J. B. Rich read the following communication from Dr. Vanderweyde, of Philadelphia:

PETROLEUM AND THE INSURANCE COMPANIES.

It is surprising to see how long a time it takes for simple facts to become universally known. It is still more surprising to see that those who are directly interested in the knowledge imparted by the experience of scientific investigators neglect to obtain the, to them, so necessary information, till in the end they are taught their great and sometimes irreparable loss by their own experience.

A striking illustration of this fact is seen in the actions of the insurance companies in the case of insuring petroleum distilleries, and in the action of the Legislature regulating the storage and refining of that substance. Millions of dollars would have been

saved if, in time, the advice had been taken of those scientific men who had given their attention to investigate the properties of this most interesting substance. A few years ago it astonished me, like it undoubtedly did every other chemist, for what a comparative trifle a petroleum distillery was insured, and with what impunity merchants were allowed to collect hundreds of barrels with petroleum in the centre of densely populated quarters of cities like Philadelphia and New York.

When we look at the enormous flame and heat produced by the burning of a single pint of light Pennsylvania petroleum, and the consequent danger of heating 100 barrels, or 32,000 pints, and even more of this highly inflammable material, immediately over the fire, to a heat far surpassing that used for a high pressure steam engine; when we know that the least leak will set the whole mass into a blaze *which no water can possibly extinguish*; when we look at the explosive nature of the vapor of this substance when mixed with air, which is a thousand times worse than gunpowder, as this will only explode by contact with the spark, and petroleum will take fire at a distance where its vapor reaches a flame; when we look at all this we are astonished at the ignorance of insurance companies that they insure petroleum distilleries at all, and of the Legislature that it was so tardy in banishing them from the neighborhood of other buildings. They have learned to their loss, and some insurance companies have increased their premiums considerably, while others refuse to insure petroleum at all.

It probably will take them a long time to learn that there are two principal kinds of petroleum—the light Pennsylvania, of which the specific gravity is indicated by forty-five degrees of Beaumé's hydrometer, and the heavy from Ohio and Western Virginia of thirty degrees, and even below that. The first is used by distillers, and they extract from it gasoline, benzine and kerosine: the other cannot be used by distillers, as it contains no gasoline nor benzine, and very little kerosene. It is, therefore, very little inflammable, and is only used as a lubricator. In fact it is so little inflammable that a burning match may be thrown in a barrel of this oil, which will extinguish the match.

But the gravest proof of ignorance is a late resolution of some fire insurance companies not to insure any factory or other place where this petroleum is used as a lubricator: the fact being that it is much less dangerous than lard or sperm oil, for the following reasons:

All vegetable and animal oils are compounds of glycerine with fatty acids. When they become old a chemical decomposition takes place, and acid is set free, by which action it is commonly said the oil becomes rancid. This rancid or acid oil will attack the metal of the machinery. For instance, color the brass work all green; and when this rancid oil is absorbed by rags, and the rags are laying for some time in a heap, it will act on the fibres, produce heat, and finally spontaneous combustion, of which there are daily examples in different localities.

Petroleum is of another nature; it is not composed of fatty acids; consequently it cannot become rancid. If it could it would have become so long ago, as it is very old. I have tried to produce such combustion by petroleum, by saturating rags with it, and placing a thermometer in the heap, but have failed to produce the least rise of temperature. There is a petroleum paper manufactured intended to be placed between clothes against moths. A box of this paper is perfectly safe; but a box of the same kind of porous paper, soaked in animal oil, in place of petroleum, would be very unsafe, as it surely would become heated, and finally take fire.

We hope it will not take all the members of the fire department long to find out that burning petroleum cannot be extinguished with water. We suppose most of them know this, but perhaps some do not. As water is heavier it goes right to the bottom, and the petroleum floating on the top keeps burning. Some of the water will be changed into steam, from the burning petroleum around, and only cause the fire to spread further. The only way to extinguish burning petroleum is to smother it, by cutting off the supply of air. When this cannot be done it is better to let it alone than to throw water on it, as it anyhow will keep burning till it is all burned up. I have seen in Philadelphia three cases of petroleum fires, where the water poured in a tank containing burning petroleum, caused it to overflow and to increase the damage considerably, as the overflowing burning petroleum set fire to surrounding buildings, fences and sheds, which otherwise would have escaped. In two of these three cases the petroleum could have been extinguished by covering up the tanks.

The making of common printer's ink is a very instructive lesson in this respect. It may be made of linseed oil and lampblack. The oil is placed in an iron pot having a cover attached to a long handle. This pot is placed over a brisk fire till the oil boils, and when it becomes thick the fire is communicated to the boiling oil,

which burns with a large flame. When it has burned sufficiently long the lid is put on, and so the flame extinguished. Suppose, now, we tried to extinguish this oil with water. This would simply go down in the oil, evaporate by the great heat, and the steam would scatter the burning oil around and set everything inflammable in the neighborhood in a blaze. I have seen in New York such an effect produced on an enormous scale, when the firemen were throwing water in the centre of a large burning candle manufactory.

P. H. VANDER WEYDE, M. D.,
Late Professor of Chemistry, Girard College.

PHILADELPHIA, *September 24th*, 1866.

Mr. Hirsh stated in connection with Dr. Vander Weyde's letter, that he had seen bone black when saturated with petroleum raise the temperature to the boiling point. Benzole he did not consider more dangerous than any other oil. There are only a few kinds of petroleum that will heat; he had seen crude petroleum kept in tanks for two years exposed to the air, and it did not decrease in the least, but became thick and tarry.

SULPHATE OF BARYTA.

Mr. J. W. Chambers presented some sulphate of baryta from New Haven, Conn., found some six miles from the city.

Dr. Feuchtwanger said there had recently been considerable controversy in regard to the unhealthiness of paper collars, on account of the lead used in them, but now most of the collars are made with barytes instead of lead. There have been two or three patents issued lately, for using the carbonate of baryta; this gives a gloss and does not rub off when wet, as lead does. If the sulphate of baryta can be made to answer well, it will be a very important matter. Barytes has also been used for giving the fine gloss to visiting cards, and wall paper, and in England cotton collars are made by its use, having all the appearance and finish of linen.

The chairman presented the following items of scientific news:

RHIGOLENE.

Dr. Biglow of the Massachusetts Medical College, recommends for the production of local anæsthesia the use of a petroleum naptha, boiling at 70° F. a pure hydrocarbon, which he proposes to call Rhigolene, from the Greek (ῥῖγος) meaning extreme cold.

It has a specific gravity of 0.625, and is the lightest of all known liquids. Dr. Richardson of London, had used ether in an apparatus of his own construction, lately exhibited before this Society, by which the temperature was reduced to 6° below zero F. Dr. Biglow by a more simple contrivance is enabled to apply rhigolene so as to produce easily a temperature from 15° to 19° below zero. The warmth of the hand holding the phial containing rhigolene is sufficient to produce the vapor. Freezing is thus far more sure than by ether, boiling at 96° instead of 70°, sometimes fails to produce the adequate degree of cold. In small surgical operations this cheap, active and inoffensive but highly inflammable hydrocarbon will be found of good service.

Gunpaper.

This article consists of paper impregnated with a composition formed of the following ingredients: Chlorate of potash, nine parts; nitrate of potash, four and a half parts; prussiate of potash, three and a quarter parts; powdered charcoal, three and a quarter parts; starch, one twenty-first part; chromate of potash, one sixteenth part; and water seventy-nine parts. These materials are mixed together and subjected to an hour's boiling; the solution is then ready for use, and the paper is passed in sheets through the mixture. The saturated paper is now ready for manufacturing into the form of a cartridge, and is rolled into compact lengths of any diameter, from that of a small revolver to that of a 600-pounder.

After rolling, the paper is dried at a temperature of 212° Fah.; when it presents the appearance of a compact greyish mass, resembling nothing so much as a piece of vulcanised india-rubber door spring.

It is readily protected from all chance of damp by a solution of xyloidin in acetic acid. The xyloidin is prepared by acting on paper with nitric acid, one part thereof being dissolved in three parts of acetic acid of specific gravity of 1.040.

Electro-magnetic Chain of Metallic Filings.

An interesting experiment is described by M. Cauderay of France. An electro magnet is introduced into the circuit of a galvanic file, the circuit is broken at any point, and the ends of the wires are separated one from the other in a box containing filings of silver, copper, brass, or iron. These metallic particles

complete the circuit. If now one conducting wire be slowly raised, a small chain will be formed by the juxtaposition of particles will be drawn out, and if care is taken, every particle will be drawn out in one long chain. Cauderay does not believe the adhesion due to magnetism but to a superficial fusion of the filings. He has shown that these particles offer very great resistance to dynamic electricity, and upon this principle he has constructed a very powerful rheostat.

Ventilation.

The chairman opened the discussion of this subject by some remarks on the composition of common air.

In one hundred parts, by measure, are oxygen, 20.61 parts; nitrogen, 77.95 parts; carbonic acid gas, or carbonic anhydride, .04 of one part. Aqueous vapor variable with the temperature, the mean being about 1.40 parts. At 59° F. the quantity of vapor required to saturate in a given volume of air, is twice as much as at 32° F; at 86° F. it is three times that required at 32°. Traces of ammonia and carburetted hydrogen or marsh gas are found in the air; and that enveloping manufacturing towns often is slightly contaminated with sulphuretted hydrogen and sulphuric acid. Traces of nitric acid are also detected, which are supposed to result from lightning, chemically combining nitrogen and oxygen.

The proportions of nitrogen and oxygen in the air do not materially vary in hot or cold, moist or dry climates. The proportion of carbonic acid is preserved by the wants of the vegetable and animal world. The animal is sustained by inspiring air and abstracting from it oxygen to unite with carbon and form carbonic acid gas; while the plant, under the influence of light, absorbs carbonic acid and give off pure oxygen. Thus by the respiration of leaf and lung, the atmospheric equilibrium is maintained.

The proportion of carbonic acid in the air, averaging only about four parts in ten thousand, seems very small; yet it has been estimated that the whole amount of carbon in the atmosphere is greater than all found in the vegetable and animal kingdoms, and probably in all the carbonates forming part of the earth's crust. Inspired air contains four hundredths of one per cent. of carbonic acid, and expired air from three and one-third to three and a half per cent., that is, the quantity of carbonic acid exhaled is about eighty-five times more than that inhaled. The amount contained in the air of a room occupied by one or more persons, can never

be reduced to the normal amount found in the air without, even by the introduction of any quantity of fresh air. It may, however, be reduced to within the limit of health, that is to say, eight hundredths of one per cent.

The air of a dwelling may be vitiated by the human breath; by effluvia from the human skin, by the products of combustion in the common process of illumination; by gases escaping from heating apparatus and cooking ranges; by emissions from poisonous compounds, like many wall papers containing green colors produced by arsenic; by exhalations arising from damp cellars—and lastly, by the gaseous products of vegetable and animal decomposition.

The intricate and delicate structure of the organs which receive these deleterious gases will always excite our admiration and wonder. The lungs of an ordinary sized man contain about 1,750,000,000 of air cells, and the surface of the membrance is more than 1,500 square feet in extent. In one minute such a person would respire from 3 to 400 cubic inches of gas; and in one hour the quantity of oxygen consumed or combined with carbon, would usually reach 1,300 cubic inches.

The chairman then spoke at some length of the actual necessity of better ventilation of our dwellings. He described the method now used on some of the principle railways, for ventilating sleeping cars. The air to be breathed is made to pass through a chamber into which water in fine spray is forced, thus separating the air from dust and all other impurities. The plan first used on cars, for preserving fresh meat brought from the West, which consists in placing ice in the top of the inside of the car, over which the heated air from the outside passes, and, after falling to the floor, is allowed to enter the car and drive off, through an opening in the top, the warmest air, thus keeping the meat surrounded with air cooled to near the freezing point. This method, with some modifications, had been used with success in supplying fever hospitals with fresh air.

Mr. T. D. Stetson said, an experiment was tried at a stable in this city, to ventilate the stalls by allowing air to come from the outside down over the horses' heads, but it was found that the horses were always sick with colds and other ailments. This was tried for two years, when the openings were closed, after which the horses were in good health.

Dr. R. P. Stevens doubted very much the theory advanced at a

former meeting, in regard to currents of heated air being caused to ascend by the superior gravity of the colder particles, and that respiration was due to the outer colder air forcing the heated air out. Respiration is mainly due to the muscles, and is no part of a movement that we can control, and is, in part, under control of the will. The air rushes in, not because it is cold, but because there is a place for it to go in. The air rushes in, whether hot or cold. This he supposes to be the true theory. The main object of ventilation is for respiration, and it matters very little what kind of apparatus are used for getting rid of this carbonic acid gas. The great trouble is, to get rid of the odors of various kinds, both natural and artificial. Persons are affected by odors in various ways; for instance, musk is exceedingly difficult for some to breathe, and to others it is very pleasant. To some, the odor of the rose has been known to produce fainting. Some persons cannot remain in a room where this odor is. The necessity of ventilation, and the kind, differs for many persons. The Doctor himself, slept with indifference whether the windows were open or shut; he felt just the same with them either way. He remembered how very particular the doctor with whom he studied medicine was, in regard to having fresh air; and on no account hardly could he be induced to sleep in a room unless there were four windows to it, so that he might constantly inhale fresh air.

Mr. R. C. Overton stated that, when at the oil regions last winter, the place where he had to sleep was a compartment seven feet long, three feet wide and three feet high, made of pine boards. The only ventilation to it was by the cracks between each board. He did not, however, feel uncomfortable while sleeping there. This statement excited some expressions of surprise, if not incredulity; but this case is explained by the action of diffusion.

Dr. L. Bradley said, that the process of breathing is entirely muscular, and is not much under the influence of the will. When a person feels chilly, he holds his breath; they do the same when they are frightened, and this causes fainting. If a person, when chilly or frightened, instead of forgetting to breathe or holding their breath, if they will only give a few respirations, they will not faint. Mr. Henry T. Callo joined in the discussion, and denied some of the positions taken by several previous speakers.

Mr. Norman Wiard transmitted to the Association the following

extracts from the Journal of the United Service Institution, of Great Britain, vol. 11, 1859,

ON THE SANITARY CONDITION OF THE BRITISH ARMY. BY WM. A. GUY, ESQ.

"That the mortality of our soldiers, especially the infantry, and more especially the 'foot-guards,' is very much greater than that of any class of the civil population."

Annual deaths of the foot-guards, of 10,000	216
Infantry of the line, of 10,000	187
London fire brigade, of 10,000	70

"The great mortality of the British soldier is no new fact. In the spring of 1847, Sir H. De Lacy told the House that, in the Metropolitan barracks, a room thirty-two feet long and twenty feet broad was all the convenience for the eating and sleeping and general living of twenty men—two or three of them being married." Such a room would not afford more than from 250 to 300 cubic feet of air to each person.

"One of the characteristics of fever is, that it is the disease of over-crowding."

"Cholera is one of those diseases which finds out over-crowded and unwholesome places. In some of our barracks it destroyed from twice to four times as many soldiers as it did civilians."

Consumption in the army is a prevalent disease. Twenty years ago it carried off 141, of 10,000, in a year.

"At the present time diseases of the lungs is the cause of the death of fifty-eight, in 10,000, of the civil population of large towns, and 125, in 10,000, of the foot-guards."

"Soldiers in Dover Castle must have been rolling, like sheep in the marshes, in a filthy atmosphere, at the rate of 147 feet of air for each."

Barrack rooms are frequently found in basements, entered by descending steps from the surface level. The tops of the windows, which open on one side only, but little, if at all, above the ground, and that, in low rooms thus situated, a number of men may be found lodged in beds, so closely ranged, that the sick of one touches another.

Just such a state of things as "Howard" found in our prisons in 1774, and which the Legislature of that day thought too bad for even the worst inmates.

It was not the ignorance of the architects or the perverseness

of officers that caused this. The law was specific in providing that the space for each soldier should be from 400 to 500 cubic feet in temperate climates, and from 480 to 600 in the tropical climates. The commissioners recommend 600 feet, in all cases, per man, which is not a liberal supply, when the prisoner at Dentonville has 900 cubic feet.

It appears from a recent return, by Dr. Balfour, that the least average space for each patient, in the London hospitals, is 800 cubic feet.

As to the effects of over-crowding, of having too little air to breathe, the height of the parallelograms on the left table represents a height of ten feet and a depth of one foot, so that the areas correspond very nearly with the centre spaces and represent them clearly to the eye.

In the Black Hole, Calcutta, 146 persons shut up with twenty cubic feet of air each, one-third died in two hours, and only twenty-three survived after ten hours.

The Union Workhouse, Peckham, had the paupers farmed out. This municipal Black Hole was a shed of seven feet pitch in the centre and two feet at the sides, of such dimensions as to give from thirty to sixty cubic feet of air to each one. It is said to have held from 90 to 100 men when full; it was a fever factory, and sent 130 patients to hospital, in London, in one year.

In Church Lane, St. Giles, a number of rooms were found so crowded that the space for each person was from ninety-three down to fifty-two feet. One hundred and thirty-nine persons were under treatment by the Workhouse staff—eighty-eight with fever.

In one month the cholera carried off twenty-nine from this place, while within a stone's throw of the same place, in the Model lodging house, George street, occupied by 100 inmates, only one died during the same time.

In a house in Dorsetshire, as described in the Chronicle, the cubic space allowed each inmate was eighty-four feet. Four out of twelve died with fever.

In one of the parish houses, in Lancaston, where the mortality was very great, 100 feet of space was allotted to each.

In Dronet's establishment for pauper children, at Footing, each child had 136 cubic feet of air-space, and 170 deaths occurred in three weeks.

In the town Buderack, of Cambridge, 170 feet of space was allotted to each inmate, who were attacked with gaol fever.

A number of printing offices were found with an average space of 202 feet; and consumption was so prevalent that it created as much alarm as an epidemic would have done.

In Christ Church Workhouse sick wards, 288 cubic feet of space was allowed in one, and only 132 feet in another. The prevalent disease was gangrene in the mouth, which proved very fatal and intractable; all which is in marked contrast to the Pentonville prison, with 700 feet, plus ventilation, while the soldiers' barracks, but narrow spaces, minus ventilation, where it is attempted to ventilate such narrow spaces, the effort proves abortive, usually resulting in drafts, which the soldiers, in endeavoring to prevent, close the room up altogether.

Adjourned.

American Institute Polytechnic Association,
October 4, 1866.

Prof. S. D. Tillman in the chair; T. D. Stetson, Esq., Sec'y.

Fruit Ladder.

The first article exhibited this evening was Mr. Aldrich's ladder, to be used in gathering fruit. It is so arranged as to be employed as a step-ladder or a common ladder, thus saving the expense and care of one. When erected it has a large platform on the top with room enough for the basket as well as the fruit picker. It can quickly be adjusted to any height. The platform is adjustable so that it can be kept level even when the ladder is placed on the side of a hill. It is a useful implement for the farmer and gardener.

The chairman presented the following items of scientific news:

Dissociation of Gases in Furnaces.

Mr. L. Cailletet described before the French Academy of Sciences the manner in which he drew from gases from blast furnaces and submitted them to analysis. The analysis of compound gases from the hottest part of the fire gave oxygen 15.25, hydrogen 1.80, carbonic oxide (gart) 2.10, carbonic acid (garet) 3.00, nitrogen 77.86—total, 100. These experiments show that oxygen does not combine with carbon, carbonic oxide or hydrogen at very high temperatures, thus confirming the views of Deville. The air taken from furnaces at a lower temperature show the gradual disappearance of oxygen and increase of carbonic acid at lower tempera-

tures. The author concludes that compound gases cannot exist at very high temperatures.

Platinum-coated Copper Vessels.

As platinum is the only metal used in the concentration of sulphuric acid, it has long been a desideratum to coat other metals with platinium. All experiments in this direction have failed until lately. It is now announced that platinum coated copper vessels are manufactured in Berlin at about one-sixth of the vessels of pure platinum of the same size.

A New Saccharine Body.

One of the advantages arising from the typical classification of chemical compounds, is the new suggestions naturally occurring to those who compare bodies in their new relations as chemical structures without regard to chemical functions. An interesting case, in point, is the late researches of Mr. L. Carius, of France, concerning bezol $C_6 H_6$ *earl.* Viewing sugar as a hexatomical alcohol, it consists of a radical $C_6 H_6$ united with the hyrate of the sixth degree, the author was led to make a series of experiments which prove that benzol may be converted into a sugar-like body which is not, however, grape, sugar, nor any other generally known compound, but a new body to which he has given the name of *Phenose.* He combines benzol directly with hypochlorous acid (*edat*), and forms the compound he calls trichlor-hydrine of Phenose (earliltid.) Three atoms of hydrate of potash, $K_3 H_3 O_3$ (*Poltimilt*) will eliminate the three atoms of chlorine which unite with potassium forming three atoms of chloride of potassium, while three atoms of hydroxyl or *ilt* unite with *ilt*, thus producing the new compound $(C_6 H_6), H_6 O_6$. Besides this compound, benzoic acid is always formed. Purified Phenose has a sweetish taste, like grape sugar, and is as easily oxydized as the latter body. It does not, however ferment in contact with yeast.

New use for Napthalin.

This compound, $C_{10} H_8$ (*eureil*), which passed through a red hot tube is decomposed, and yields mash gas, or two atoms of $C H_4$ (*arol*), leaving eight atoms of carbon in the form of a fine soot, which Klentinsky suggests might be used for Indian ink. Napthalin (*eureil*), when fused, swells up and dissolves India rubber with great facility.

SULPHURETTED HYDROGEN.

This compound (*gelas*), when used for experimental purposes, is usually obtained from the sulphuret of iron (*Ferramas*). The Scientific Review, England, proposes the use of sulphuret of calcium (*calcamas*) for this purpose ; the gas is made more easily, and is in a greater state of purity. *Calcamas* is readily formed by mixing, in water, uncalcined powdered gypsum, with one-fourth its weight of powdered gypsum and powdered pit coal, equal to one-third the weight of the whole gypsum used. The dough is formed into pieces about four inches long by two in breadth and in thickness, which are sprinkled with powdered coal and subjected to a high heat for two hours. When cold, the outside will be found to be oxysulphuret of calcium or *calcamast*, but the inside will be pure peach-colored *calcamas.* They should be broken in pieces about nut size and preserved in tight glass bottles. If water is added to these and sulphuric acid (*elasot*), in small quantities, sulphuretted hydrogen (*elas*) is uniformly generated.

IMPURE WAX.

Mr. Lies Bodart stated before the French Academy of Sciences that a large quantity of wax was imported from America, and is more or less adulterated with paraffine. He proposed a process for separating the paraffine which depends on the etherification of the wax constituents by means of amylic alcohol (*uchelat*) and strong sulphuric acid (*elasot*); afterwards this compound is converted into sulphamylic acid, which will not hold paraffine in solution.

NEW BLUE COLOR.

The *Moniteur Scientifique* contains an account of a new blue obtained by Horace Kœchlin. An alkaline solution of chloronapthalate of soda (*sodam-eurladot*) is boiled with zinc in impalpable powder which, after twenty minute's, results in a pale yellow solution. The liquor is decanted and ammonia (*gilan*) added, which, in a few hours, changes to a beautiful green. This solution neutralized by an acid, causes the precipitation of brown floccali, which, when collected and dried, appears green, with a metallic luster. It dissolves in alcohol (*echelat*) with a violet color; this diluted with water, gives a beautifnl blue color. It dyes silk blue, and wool and cotton when mordanted with albumen.

A New Battery.

Mr. Torreggiani described before the French Academy of Sciences, a new battery. The positive pole of the pile is represented by metallic lead, and the negative by carbon. It contains an alkaline acetate solution, which gives a large quantity of pure carbonate of lead (*plubmarit*), besides electricity, which may be profitably employed. This is an innoxious method of making white lead, and if economical, when electricity is generated for telegraphic purposes, it may be of considerable importance.

Danger in Preparing Acetylene.

Dr. Calvert, in a note to the *London Chemical News*, calls attention to the great danger in preparing formyl or acetylene C_2 H. according to Kletinsky process, which is to fuse together under naptha twenty-five grammes of mercury and ten grammes of potassium. The dried amalgam is rubbed to powder and heated in a flask with ten grammes of pure chloroform (*eralid*), sets free a litre of acetylene (*erel*). Dr. Calvert states that after gentle heat had been applied for about ten minutes to the mixture of chloroform (*eralid*), and the amalgam of potassium, a terrible explosion occurred, destroying much valuable property, but fortunately injuring no person in the laboratory.

Draft of Chimnies.

During the discussion on ventilation, the chairman submitted the following brief:

1. The draft of a chimney, or flue, depends mainly on the difference between the temperature within and without.

2. A tall chimney will increase the draft, because it limits the spreading or lateral action of the products of combustion, keeping them in one straight continuous column, and protecting them from the cooling effects of the surrounding air.

3. Too tall a chimney will impede the draft, because the ascending column is impeded by greater friction against the sides of the chimney, and is cooled to a greater extent by radiation from the outside of the chimney. A new and damp chimney, even if short, will absorb the heat in the smoke, thus lessening the draft.

4. The higher the heat of the smoke, the greater will be the difference between the temperature, outside and in, and the greater will be the draft *within certain limits.*

5. Too great heat in the smoke will diminish the draft, because

although the velocity of the column may be greatly increased, its volume, also, having been greatly increased by expansion, the actual quantity of air entering at the bottom will be lessened. The limit to which the ascending column may be heated, is about 500° F. Any additional heat beyond this point will diminish the draft. Thus nature interposes a law to prevent too great a waste of heat.

6. A flue of large area or capacity is favorable for drafts, because the amount of friction of the ascending column is proportionately less.

7. Too large a flue diminishes the draft, because the smoke, moving at a slower rate, is longer exposed to a greater surface of the chimney, and drags with it more cold air, drawn in through other openings than that beneath the fire.

8. A certain quantity of air is necessary for combustion; if it should be entirely shut off below the fire, and two flues were connected therewith, the cold air would pass down one flue, to supply the oxygen needed for combustion, and the smoke would pass up the other flue.

9. Too great a supply of air is detrimental. It dampens the fire, cools the ascending column, checks the draft, and lessens combustion.

10. A chimney gradually increasing in capacity from the bottom upward, tends to increase the draft.

11. A chimney flue gradually increased in size from the top downward, for a short distance, will lessen the effect of downward currents produced by gusts of wind.

12. Wind blowing horizontally generally increases the draft, because any current moving in a right line tends to draw with it another like current moving perpendicularly to it.

13. Wind will retard the draft, provided there are open windows in the room from which the draft is supplied, which are parallel with the course of the wind; for, in that case, the so-called suction-force of the wind will be greater below than above.

14. The best draft and most economical fire is secured by closing, air-tight, the lower portion of the chimney, and every part of the heating apparatus except the damper, which regulates the fire and which, to produce perfect combustion, should admit two-thirds of the air used under the fire, and one-third above it. By this means the combustible gases, which often pass off unconsumed, coming

in contact with the oxygen of the air let in through the upper damper, are perfectly burnt, and thus the whole heat of complete combustion is generated.

Effect of Currents.

Dr. Rowell performed a simple but very interesting experiment to illustrate the drawing force of currents. Two blocks of wood, each an inch thick, and about one foot long, were placed on a table parallel with each other and about two inches apart. Over this space, and on the blocks, was placed a sheet of paper of the same length. On applying a hand-bellows to one end of the passage and blowing through it, many supposed the paper would be blown off. Just the opposite was the effect; the paper was drawn in towards the centre of the passage.

Patent Fuel.

Mr. C. Edwards Lester exhibited specimens of a compound fuel, and in an address of nearly an hour entertained the audience with a history of the trials which had been made to produce a fuel from materials which have formerly considered waste products. The fuel of which he showed samples, he said could be delivered in New York at $2 per ton, and which cost at no place in the United States more than $3 per ton. Peat, the basis of the fuel, was found abundantly in all the States of the Union. He stated that it had twice the heating property of anthracite, taking bulk for bulk. It had 13¾ per cent greater specific gravity than anthracite; and while ordinary anthracite left eighteen to forty per cent ash, the patent fuel never left less than three, nor more than six per cent. Beside this, there is a great saving in stowage, on account of the square blocks. Thus, a steamer which now carries 1200 tons anthracite in crossing the Atlantic, would save half the space now taken up by coal, and carry in lieu thereof paying goods. The importance of the new fuel on the San Francisco and China route would be still greater. This fuel had been the object of study for Mr. Halstead and himself during the past two and a half years. They had made above 1,300 speculative trials, were themselves perfectly satisfied as to its success, and were constantly burning it under their small boiler (165 galls.) at Trenton, New Jersey, where it started the engine in seven minutes. It had also been used during a run of forty miles by steamer on the river,

where the saving of kindling wood, usually employed in starting the anthracite, came to more than the cost of patent fuel. The Pacific Mail Steamship Company had offered them one of their steamers for a trial trip to sea, and in a few days he would send invitations to the members of the Institute to accompany it. The fuel is thus composed: sixty to sixty-five per cent of peat, about twenty per cent of anthracite dust, ten per cent coal tar, five per cent asphaltum, but varying in proportion for different purposes, whether metallurgical, domestic or other. The peat, dug in the usual manner, is laid in the air to dry; and when dry enough to be mixed with the other materials, it is put into a press, and with one blow compressed. Next day it is ready for use. It can be prepared by any farmer.

Dr. R. P. Stevens objected, that since the value of fuel was reckoned by the quantity of carbon it contained, and since peat possessed much less carbon than anthracite, he could not see how peat and anthracite together should produce greater heat than anthracite alone.

After some further discussion of the subject of cheap fuel the Association adjourned.

American Institute Polytechnic Association,
October 11, 1866.

Prof. S. D. Tillman in the chair; T. D. Stetson, Esq., Sec'y.

Asbestos Gloves.

Dr. D. D. Parmelee exhibited a glove of Hungarian make, which it was said would enable the wearer to hold a heated crucible. It was made of asbestos, a fibrous mineral, and such gloves cost $20 a pair.

Mispikel.

Dr. Feuchtwanger exhibited some specimens of arsenical iron, known as mispikel. We import 100 tons of arsenic a year at four cents a pound, while we can make it here from our numerous ores for one cent per pound. All that is required is a common furnace about 100 yards long with a wooden chimney, which would make as much as we import.

The Chairman presented the following notes on scientific progress:

New use of Chrome Compounds for Coloring.

Mr. I. H. Chaudet of Rouen, France, by means of the action of sulphurous acid on chromates produces sulphates and sulphites

which are utilized in obtaining various salts of chrome. His method is as follows : In a cast iron retort forming a continuation of the bellows or blowing machine he introduces a certain quantity of sulphur, which is lighted. This retort communicates with the washer which conducts to the reducer containing chromate in solution. On putting the bellows in motion the sulphurous acid resulting from combustion is forced into the chromate solution which is taken up while the nitrogen of the air used in the combustion is disengaged. If bichromate of potash or of soda is employed sulphates and sulphites of chrome, also of potash or of soda are formed, which remain dissolved. If chromate of lime is used the sulphate of lime is precipitated while the snlphate of chrome remains in solution. Similar action takes place with the chromates of lead and baryta. Separating the insoluble sulphates by filteration leaves tolerably pure sulphate of chrome. Mr. Chaudet prefers to employ the bichromate of lime obtained direct from the treatment of chrome ore by lime. Chrome oxide (hydrated) may be produced by subjecting the chrome sulphate to the action of ammonia or the alkaline carbonates. This oxide may be used with advantage in coloring glass and porcelain. The sulphate and nitrate of chrome are used as mordants for silk and wool in order to obtain novel shades with divers coloring matters. The acetate, nitrate, citrate and tartrate of chrome, easily obtained by double decomposition, are used by Mr. Chaudet on cotton and textrile vegetable productions.

The use of the salts of chrome as a mordant with different tinctorial matters, will give the different colorations here recited :

Campeachy produces blue and blue-black ; red wood, violet red; Sanders, red; Jamaica rose-wood, golden yellow; quercitron, clear yellow; fustic, mahogany yellow; woad, emerald yellow; curcuma, copper yellow; Persian berries, straw color; roucou, flesh color; madder, fallow red; nut gall, fallow brown; sumach, yellow brown; catechu, sienna clay; cochineal, purple red; carmeline, carmine red; aniline, violet and fushia; yellow prussiate, green; orchilla, violet red; red prussiate, green blue.

By using the salts of chrome as mordants fast colors are obtained which do not turn green on exposure to the air, like, for example, those produced by the use of the bichromate of potash. In the latter case the oxygen is transmitted to the coloring matter, leaving the oxide of chrome, which is naturally green. A different result takes place when the oxide of chrome or a chrome base is

used as mordant, owing to the affinity which the base has for the textrile and coloring matters, and there is no tendency to further reaction. Mr. Chaudet obtains the same result by putting in contact with the textrile matter, mordanted with bichromate of potash, a reducing body such as sulphurous acid, the alkaline sulphites, the organic acids, alcohol, sugar and its congeners, by which chrome oxide is formed after which the substance is washed and dyed the desired color.

Heat conducting Power of Mercury.

M. Grisson has given to the French Academy the results of his experiments. If the heat-conducting power of silver be taken at 100, that of mercury is only 3.54 or about 28 times less than silver. Mercury conducts heat more slowly than any other metal, and but little faster than marble and gas-coke.

Relation of Atomic Weights to Volatility.

Bunsen's experiments show that there is a close relation between the atomic weights of certain compounds and the degree at which they become complete vapors. In the following table the first column contains the name of the compounds; the second their atomic weights; the third their degree of volatility; and the fourth the result of the division of the numbers of the third column by those of the second.

Lithium-chloride, (*Lithamad*)	42.49	0.739	0.0174
Sodium-chloride, (*Sodamad*)	58.43	1.001	0.0171
Potassium-chloride, (*Potamad*)	74.57	1.288	0.0173
Sodium-bromide, (*Sodamab*).......	102.97	1.727	0.0168
Potassium-bromide, (*Potamab*).....	119.11	2.055	00.173
Rubidium-chloride, (*Rubamad*)	120.82	2.183	00.181
Sodium-iodide, (*Sodamav*)	150.07	2.360	0.0157
Cœsium-chloride, (*Cœsamad*)	168.46	2.717	0.0161
Potassium iodide, (*Potamav*).......	166.21	2.828	0.0170

The close approximation of the numbers in the third column leads us to surmise that the points of volatilization of these compounds are directly as their atomic weights.

Voyage of the Red White and Blue.

This little full rigged sailing vessel, only twenty-six feet long, six feet two inches wide, with a depth of hold of two feet ten inches, tonning 2$\frac{38}{95}$ register, manned by Capt. John M. Hudson,

and Mate F. R. Fitch, sailed from New York on the 9th day of July, at 5 P. M., and arrived at Margate, England, on the 16th of August. The voyage from New York to the chops of the channel was performed in 34 days, to Margate in 38 days, and to Gravesend in 40 days and 16 hours. It may be gratifying to the members of the Institute to know that the little ship was *the identical metallic life-boat* exhibited by Mr. O. R. Ingersoll, at the last fair of the American Institute, held in the Armory, on Fourteenth street, and for which a gold medal was awarded. The log of the Red White and Blue, as published in the N. Y. Times, with other interesting matter, is hereto appended.

Log of the Red, White and Blue, the smallest boat that has ever crossed the Atlantic Ocean.

The voyage of the ship-rigged Ingersoll lifeboat, *Red, White and Blue*, which sailed from this port on the 9th of July last, was regarded as a hazardous undertaking; but Captain Hudson has accomplished it with safety, his stalwart little craft weathering the heaviest seas with a bravery which was praiseworthy. The log which the captain furnishes for the gratification of our readers, will be perused with considerable interest.

Sailed from New York July 9, 1866. Crew consisted of Captain J. M. Hudson, and Mr. F. E. Finch, with dog "Fanny" as guest. Object of the voyage, to test the lifeboat, and also to visit different parts of the Old World in our private ship.

Departure.—At 5 P. M., we parted from the steamer *Silas O. Pearce* off Sandy Hook. Many white handkerchiefs waved in the breeze, and then went to the bright eyes of the warm-hearted friends who were praying for our safety, but acted as if they never expected to see us more. We stood out to sea (light breeze from the southwest) at 7.30. Wind shifted to the northwest and freshened up. Nine P. M., lost signal lamp overboard. Passed, during the night, many vessels. At midnight were at the Highlands of Neversink—distance twenty miles. Here

Arranged Watches—each man four hours on and four hours off; but when it was necessary to "take in sail" all hands were to be "ordered on deck." July 11, fresh wind and heavy swell. Shortened sail, and kept ship to the wind very well with only foretopsail. Spoke pilot-boat *A. T. Stewart* and another, and reported ship working well so far. Ship pitched some; could not use our kerosene stove. Made forty-two knots to-day, and ship close-

hauled. July 12, wind shifted to westward, with fine weather. Made some warm mutton soup—the best we ever tasted—out of cans. Toward evening wind freshened, and we bowled off at the rate of seven knots per hour. Made a run of one hundred and sixty-eight knots in the twenty-four hours. Felt quite elevated, but rather lonely on our watches. Dog "Fanny" appeared sea-sick; gave her one can of beef. July 13, discovered our only timepiece had stopped from exposure to the wet; was rusty inside; hereafter must mark time by the sun. "Fanny" found a dry spot to-day and took it out in sleeping. July 14, made a fair run of one hundred and thirty-nine knots. July 15, wind northeast to southwest, and light; course east by southeast; run only sixty-three knots, much of which was due to the gulf stream.

A Discourteous Captain.—During the afternoon was becalmed, in company with a bark about two miles distance. A light air springing up, we headed to speak her, but she bore around to the north and kept off, evidently not wishing to speak us. I cannot say much for that captain's humanity, who would pass a small ship twenty-six feet in length, with only two men in her, five hundred miles from land, without desiring to speak her, even if he could do nothing. July 16, course east one-fourth north; distance made ninety-two knots; wind southwest and west; difference of latitude 5°, departure 91°. Latitude by d. r. 39°; latitude by observation, 39° 6′; variation $1\frac{1}{4}$; difference of longitude 118°; longitude 61° 49′. July 17, made one hundred and twenty-four knots; wind northwest and west. July 18, latitude 40° 31′ north, 35° west; about midnight struck something very solid, and glancing on the port bow; all sails were set; the concussion stopped the ship's headway; examined and found ship did not leak. Had it been an ordinary wooden boat, this blow would have sent us to Davy Jones' Locker. Made one hundred and four knots this day. July 19, 20, 21, 22, 23, made one hundred and fifteen, ninety-nine, twenty-six, seventy-two and one hundred and nineteen knots, respectively. Heavy sea on, but our little ship rode the waves like a thing of life way up on the mountain billows, the sea hissing and lashing around us; at times we would be covered with the spray, and the air would be full of horrible uproar, seemingly upbraiding us for our temerity; but we dashed on, daring old ocean in his gloomy mood. He had no terrors for us; we were not born to be drowned.

In a Fog.—July 24. About 3 P. M., while running with a souther-

ly breeze, through a dense fog, could not see more than the length of the boat, passed through a strong current-ripple; got into it before I could see it; the water for about sixty yards in a fearful foam and tossing very dangerously; boat would hardly steer; was a long time getting out; sometimes her headway was stopped; it resembled Hell Gate, New York. From that fact, and feeling like ice, I concluded we were in the Polar. This was in latitude 44° 12′ N. and longitude 46° 47′ W. July 25, 26, 27, 28, 29, 30 and 31, made eighty-five, eighty-nine, one hundred and seventeen, one hundred and seventeen, one hundred and seventy-two, fifty-one, one hundred and twenty-nine knots per day; waves dashed very high at times, and were obliged to put the boat before the sea to prevent some of them taking passage on board, as our accommodations already were somewhat cramped. On the 30th, at 3 A. M., a large whale came very near us, evidently wishing our acquaintance. We kept away from him, preferring to pick our own company. On the 31st, from 8 P. M., until midnight, we had fresh breezes from southwest and overcast. The water sparkles so much that it is almost light where the sea breaks. Towards midnight several seas in succession come rolling along, carrying the ship with the greatest velocity, so that the sails were hard back. I never saw the like before at sea. August 1, 2 and 3, run one hundred and thirty, one hundred and nine and one hundred and fourteen knots; raining, everything wet and disagreeable; frequently treated to a cold bath. Waves dashed over us considerably. August 4, course E. $\frac{1}{4}$ S.; distance seventy-six; difference of latitude five: departure seventy-five; latitude by dead reckoning, 47°, 15′; latitude by observation, 47° 5′; variation $2\frac{1}{2}$; difference of longitude, 110°; Lon. in., 19° 23′. Wind all around the compass. Sighted a bark; the first sail seen for twenty days, and saw the glorious bright sunset the first time for ten days. Oh, such ten lonely, dreary, long, long days! No animate thing around or about us. Left to ourselves and our own thoughts. Dark, dull and gloomy all around, with naught but a thin plate of iron, about as thick as a sheet of tin, between us and the ocean's bottom; but our boat is a lifeboat indeed. I here bear testimony to Mr. O. R. Ingersoll's lifeboat. It seems impossible to capsize her. The side cylinders, when she appeared to be going right over, would, as it were, catch and throw her back on her keel.

Spoke a Hospitable Captain.—August 5. Sighted another ship.

She ran down to us and proved to be the bark the *Danish Princess*, of Nova Scotia. She hove to, and we ran under her lee, and got from her an old white signal light, and the *Irish Times* and *Freemason's Journal* of July 24th. She was seven days out from Dublin, bound to Quebec. The captain before parting gave us a bottle of rum, which we found was very good on wet days. Lon. 22.10 W. August 6.—Very heavy seas running crosswise. About 5 P. M. a blind sea came up on port-quarter, which threw her on her beam ends, but she righted in a half-minute. We have carried sail pretty hard but never saw her do that before. The dangerous sea was the cause, as we had only the foresail, foretopsail, foretopmast staysail and jib set. Made one hundred and nine knots to-day. August 7, course E. half S.; distance made, one hundred and three knots; difference of latitude 12°; departure, 102°; latitude, dead reckoning, 47° 16′; latitude by observation 47° 16′; variation $2\frac{1}{2}$°; difference of longitude 150°; longitude 17° 21′; wind W. to N.W. August 8, 8.30 A. M., shipped a heavy sea, which again threw the ship flat on her starboard beam-ends; got her back by getting the topsails down and keep the helm hard up. Our spars are very long, and we have to carry our topsails to catch the wind when down in the waves, hence we are top-heavy for so small a boat. The side cylinders act splendidly; made one hundred and twenty-four knots. August 9, same terrible sea on; the water is all agitated; again on her beam-ends, but soon righted again; made one hundred and nine knots; 10th, 11th and 12th made one hundred and two, seventy-three and eighty-three knots; waves very high; strong westerly and northwesterly winds on the 12th.

A large shark came alongside and kept us company; boat pitching and tossing furiously, but she rides triumphantly, and his royal highness, the shark, must elsewhere seek a victim; he never shall dine off us. It is hard though to keep from being washed off deck.

August 13, spoke bark (American) *Nellie Merryman*, Capt. H. A. Rawlins; gave us two bottles of brandy, and the bearings of the Bight of Portland; told us it did him more good than if he drank it himself. God bless him. We had now been in the track of the vessels for several days, but none of them troubled themselves with us.

Land, Ho!—Sunday 14. Twenty-seven miles north of Ushant we found we had overrun our reckoning about sixty miles in a run of 3,300 from New York. To-day at noon made land. Our voyage is accomplished, and here we give thanks to Him who

holds the seas in the hollow of His hand. We passed up the channel and communicated at Hastings with some fishermen, who told us that the *Great Eastern* had successfully crossed the ocean and laid the Atlantic cable. At Deal we were offered a pilot; declined. Rounding the South Foreland we beat up against a head wind to Margate; 16th, blowing heavy from W. S. W. Capt. Thomas Wather, of the boat *Jessie*, seeing the wind so heavy came along and towed us into harbor. The crowd cheered us heartily. We remained at Margate until the 18th, and were glad to stretch our tired limbs in a bed on shore. Our dear little dog Fanny died here at our feet. Poor dog! Childish as it may appear, we wept over her body. We have crossed the ocean in thirty-four days, met storms and winds, and have demonstrated that an American lifeboat, with an American crew, can cross the stormiest ocean in the world.

JOHN M. HUDSON,
Red, White and Blue.

After the lifeboat's arrival in England some few persons doubted the fact of her having sailed across the ocean, when the following challenge was sent to Europe, and was extensively copied by the press. It was, however never accepted :

To the Editors of the London Herald :

"Sir—Doubts have been raised as to the Ingersoll metallic lifeboat *Red, White and Blue* having made the passage across the Atlantic. As the little boat and her brave crew were spoken in mid-ocean, after having left this port, one would think this in itself was enough ; but if there are any who are not satisfied even yet, I am willing to wager the sum of $10,000 in gold against $1,000 that she did cross the ocean ; and, further, I will wager $10,000 in gold against a like amount that Captain Hudson and Mr. Fitch can do it again. I will give the first $1,000 to the poor of London, and on the second wager, if I win, I will give one-half to the poor of London and Liverpool, and one-half to Captain Hudson and Mr. Fitch. This certainly is a fair offer to any and all who would seek to deprive both the men and the boat of the credit they deserve.

"Very respectfully your obedient servant,
"OLIVER ROLAND INGERSOLL,
"*Metallic Lifeboat Builder*,
"New York, *Sept.* 24, 1866." "243 *South-street, New York.*

Soon after the voyage the *Danish Princess* arrived in England, and her gallant captain and crew hastened to make and publish the following, which we extract from the London *Daily News* October 30, 1866, and which forever settled the question; and those who have been loudest in expressing their doubts now become the warmest in expressing their satisfaction, coupled with regret for the pain they had caused Capt. Hudson and Mr. Fitch:

"At Troon, the 22d October, 1866, appeared before me Robert C. Reid, one of her Majesty's justices of the peace for the county of Ayr. Mr. George A. Baker, master of the barque *Danish Princess*, of Yarmouth, Nova Scotia, from Quebec, who declares that Captain Tooker, the former master of the said barque *Danish Princess*, on his arrival at Quebec reported having spoken the little ship *Red, White and Blue*, from New York, bound for London, twenty-seven days out, under full sail, with royals set; and that in overhauling the log-book of the said barque he there found recorded the day, date and position of the little ship when it was spoken. The day was Sunday; the date 5th August, 1866, and the position latitude 47.19 N., longitude 22.10 W. He, the said George A. Baker, further declares that in joining the said barque *Danish Princess*, the only individuals belonging to the former crew he found were two lads, now on board said barque, whose names are William John Norman and Philip M'Cormick, and who make declaration as under.

(Signed) "G. A. BAKER.

"Signed and declared this 22d day of October, 1866, before me at Troon,

"R. C. REID, J. P."

"We, the above designed William John Norman and Philip M'Cormick, having been on board the barque *Danish Princess* on Sunday, the 5th day of August, 1866, on the passage from Dublin to Quebec, declare that we fell in with, and spoke, the little ship *Red, White and Blue*, from New York to London, twenty-seven days out, under full sail, with fore and main royal set. The crew on board the little ship consisted of two men and a dog. They were asked if assistance was needed, to which they answered 'No. All well.'

"W. J. NORMAN,
"PHILIP M'CORMICK.

"Signed and declared at Troon, this 22d day of Oct., 1866, before me,

"R. C. REID, J. P."

The boat has been exhibited in the Crystal Palace, London, and thousands have visited her, including many of the distinguished nautical men of the world, as well as the nobility and those of all classes. She will be exhibited in this country, perhaps, after her *return across the ocean*. The result of this experiment shows that a lifeboat can be so constructed as to be relied on in the emergency of a vessel foundering at sea. The following extracts from the press on both sides of the Atlantic show how the event was regarded:

From the London Morning Star, Sept. 6, 1866.

"Perhaps the most interesting and surprising object ever submitted to the inspection of the public, is the wee craft, as it has been appropriately re-christened, which has accomplished the marvellous feat of safely crossing the Atlantic."

From the N. Y. Journal of Commerce, Sept. 5, 1866.

"Had the trip been made over a smooth sea it would have been sufficiently marvellous, but the weather was unusually boisterous, with very heavy seas; but in spite of all these impediments the Sea King was beaten; compelled to witness her safe arrival at the port where she was welcomed by thousands of delightful spectators."

From the New York World, Aug. 18, 1866.

"One thing has been demonstrated by this wonderful achievement in naval architecture, namely: passengers need have small fear to commit themselves to this lifeboat when in mid-ocean and compelled to leave the ship. The *Red, White and Blue* has safely weathered very rough seas, because the *Great Eastern*, that was shuffling off the immortal coil at the same time, circumstantially reports an extremely severe passage, while this increased the danger and difficulty of the voyagers and the apprehension of those that vividly remembered their situation, it is a tribute to the boat and men now that their safety and reputation are assured, and will be referred to with pride where it was but recently spoken of with anxiety."

From the Weekly Nation, Aug. 23, 1866.

"The enterprise was performed by men who had the greatest faith in the sea-going qualities of Ingersoll's metallic lifeboat.

From the London Daily Telegraph, Aug. 27, 1866.

"No one will deny the credit attached to the demonstration of its being possible to cross the stormiest ocean in the world in a cockle shell."

Petroleum Products.

Prof. Vanderweyde, of Philadelphia, made a very complete display of all the compounds into which petroleum is separated by distillation. The lightest product exhibited was a vapor at ordinary temperature, but by slight pressure was reduced to a liquid, a bottle of which was shown. The speaker proposed to use it, as rhigoline has been used by Dr. Bigelow, of Boston, for local anæsthesia. All that is required is to loosen the cork, and allow a little of the liquid to escape on that part of the body to be chilled, the immense amount of heat absorbed on assuming the gaseous form being thus abstracted from the part in contact with it; but more case must be taked than with that distilled with a higher heat, which is liquid at ordinary temperature.

The product known as *gasoline*, lighter than kerosene, is burned in a lamp fitted for that purpose, which is filled with saw-dust. The fluid is then poured into the inverted lamp through an aperature in the bottom. It has no wick, but in place of it a tube perforated with four or six very small holes. On exposing the tube to the flame of a match, enough heat is obtained to generate gas, which, on issuing from the tube, takes fire and gives a very brilliant light. The tube thus heated by the flame continues to generate the required gas. The lamp, as well as the can by which it is filled, has its large aperatures covered with wire gauze, similar to that used in Sir Humphrey Davy's safety lamp, to prevent the flame from reaching the interior.

The products of some petroleum wells contain nitrogenous matter, from which the beautiful aniline colors are made. These were exhibited; also paraffine, which has lately been used for making ordinary thin wrapping paper impervious to air and moisture.

Several other petroleum hydro-carbons used in the arts were shown, but the speaker devoted most time to setting forth the advantages derived from the body used as a lubricator.

The following is the paper of Dr. Vanderweyde,

On the Requisite Qualities of Lubricators.

I have made it a subject of careful study to find out the different qualities required for a perfect lubricator, have carefully analyzed different lubricators, have compared them by means of apparatus constructed for this special purpose, and I have finally come to the conclusion that a perfect lubricator, which will answer

all the requirements, must satisfy ten distinct conditions, which I will enumerate.

I have gone over this labor more as a labor of love than of profit, being persuaded that the subject is most important, more so than the majority of people are aware of; we only have to take in account the large amount of useful power lost all over the world, even in the best constructed machinery, by inferior lubricators, an amount of which, easily two-thirds, could be saved; also the ruinous effect on the machinery itself by inferior lubricators, heating it, wearing it out, throwing it much sooner out of repair, and causing it to last not half the time that it would do with perfect lubricators.

The conditions required of a perfect lubricator are as follows:

1. It must not freeze or solidify at the temperature of our coldest winter days, say 10° below zero, Fahr., as is the case with sperm and lard oils, which freeze, some at 40°, some already at 50°, and even at 60° above zero.

2. It must not dry and form a gummy crust, like linseed oil, which has the virtue of not freezing, before reaching 8° or 10° below zero, but which is only an excellent lubricator as long as it is fresh; it is, however, a drying oil, and soon forms a crust. Fish and rape oil will do the same, only it takes much longer time before they gum.

3. The oil must not be a compound of fatty acids with glycerine, as all those oils become rancid by exposure to the air, which rancidity is only a decomposition by which the acid is set free; this acid acts on metals like brass, corrodes it, as is seen in the green color of many lubricators when in contact with brass; all vegetable and animal oils have this chemical composition, and therefore are objectionable on this account.

4. Those same oils will, for the same reason, produce spontaneous combustion when the woolen or cotton rags used for cleaning the machinery are saturated with it, and accumulate in a closet or box; the action of this oil on the fibres of the rags produces a steadily increasing heat, and has been the cause of many a fire, as is universally known. I observe in the annual of *Mechanical Technology* (Berlin, 1863, page 47) that Prof. Bolley draws the attention to the fact of cases having been found where the fatty acids of the lubricators came with the feed water in the steam boiler, and, combining with the lime in the water, increased the incrustation considerably.

5. The oil must not have been treated with sulphuric or other acids, as is the case with refined rape oil, or deodorized heavy kerosene; besides the injurious effects of the accidental remnant of those acids on the metal, the lubricating smoothness of the oil is destroyed, it feels rough between the fingers, and does not diminish the friction as much as the same oil not treated with acids, as I prove by experiment.

6. It must be pure and perfectly transparent, and contain no gritty, earthy, or mineral matter which will attack the machinery, as is the case with crude petroleum, of which the heavy black variety is now extensively sold as a lubricator, and may do well enough for coarse machinery, but contains a very fine grit, like polishing powder, and is not to be recommended for locomotives and similar valuable machinery. The same may be said of the tar left from the distillation of light petroleum, in which the natural lubricating parts of the petroleum are mostly destroyed, burned away, and which contains fine free carbon in suspension; this tar being too thin, is melted together with common rosin to thicken it, and sold as a superior wagon grease, which by the way it is not; its only virtue is that it is very cheap. About the transparency spoken of under this head, I will still remark that the color is of no importance; the light colored oil is not better than the dark red; I have even found that all attempts at giving oil a very light color are made at the expense of some of the lubricating qualities, the transparent but dark reddish oil being in reality the best lubricator.

7. It must not evaporate and leave the parts dry, as is the case with kerosene, parafine oil, coal oil, and in general all distilled oils, which being products of distillation, that is, condensed vapors, will of course evaporate again, principally when the parts become warm by friction or otherwise.

8. Not only can no good lubricator be the product of distillation, but the substance itself must never have been submitted to a certain degree of heat, sufficient to cause a chemical change in its constituents to take place; when an oil has been boiled it is ruined as a lubricator; any boiled vegetable or animal oil is inferior; so is tar. And even if the oil was only heated to a temperature considerably below its boiling point, the lubricating qualities are much impaired.

9. It must not be too thin; but thick, adhesive, and stick to the parts, not being removed by mere friction, as is the case with

heavy kerosene and parafine oils, which drain entirely off and leave the parts dry.

10. It must not be too thick, like tallow or frozen sperm oil, as those substances will not penetrate to the parts to be lubricated. Even the so boasted of Mecca oil was found defective in this respect at the Brooklyn navy yard, as it was too thick to penetrate between the axes and journals when the pressure on them was considerable; however, for some heated parts of machinery, as the cylinders of steam engines, tallow or a thicker oil may be preferable; and in general the oils should be adapted to the machinery on which they are to be used; and even different parts of the same machine should be lubricated with a different oil, each oil adapted to the functions the part has to perform.

This summary of the requisites of a good lubricator is, in fact a criticism on the existing oils used for this purpose; it shows that none are perfect, and that there is great room for improvements. In the future I will give the results of some further investigations, with which I am now occupied.

Dr. J Hirsh said he found that if petroleum is poured slowly into bone black the temperature will rise instantly; he noticed that it got quite hot in a few days. Petroleum will always heat if absorbed by a porous substance.

This position Dr. Vanderweyde positively denied. He also remarked that now an axle grease is made of parafine and very heavy petroleum. The naturally heavy petroleums are the true lubricators.

Mr. L. B. Page said he had a pair of boots that were tanned with petroleum.

Drs. Parmelee, Rich, Messrs. Overton, Walling, and others, participated in an interesting debate, after which the association adjourned.

American Institute Polytechnic Association,
October 18, 1866.

Prof. S. D. Tillman in the chair; T. D. Stetson, Esq., Secretary.

Dr. R. Rowell exhibited indicator cards from the Expansion Steam Engine built by the U. S. Government for the purpose of making experiments regarding the value of the cut-off. These experiments are still in progress at the Novelty Iron Works. Dr. R. promises to furnish a detailed account of these experiments at some future meeting.

The chairman exhibited specimens of peat taken from the ground in Prospect Park, Brooklyn. It covers an extent of about 500 acres, and is about 15 feet in depth. It did not, however, appear to be a good quality of peat for burning, on account of the earthy matter mingled with it.

Mr. L. B. Page presented a vial of crude petroleum as black as coal. A portion of the same lot of oil he had simply passed through boneblack, which made it almost as clear as water; but in passing the oil through boneblack there is a loss of about 20 per cent. This oil is an excellent lubricator; it does not become gummy. Some persons who use it perfer it to sperm.

The chairman presented the following paper:

Researches in Magnetism and Electricity.

H. Wilder, Esq., England, has made a series of interesting experiments in electricity, and claims to have discovered a means of producing dynamic electricity in quantities unattainable by any apparatus hitherto constructed. He has found that an indefinitely small amount of magnetism, or of dynamic electricity, is capable of inducing an indefinitely large amount either of magnetism or of dynamic electricity. His apparatus consists of a hollow compound cylinder of brass and iron, called by him a magnet cylinder, having an internal diameter of one and five-eighths of an inch. On this cylinder could be placed, at pleasure, one or more permanent horse shoe magnets; each of which weighs about one pound, and sustains a weight of about ten pounds. An armature is made to revolve rapidly in the interior of the cylinder, in close proximity to its sides, but without touching. Around this armature 163 feet of insulated copper wire, 0.03 inch in diameter, is coiled, and the free ends of the wire are connected with a commutator, fixed upon the armature axis, for the purpose of taking the alternating pulsations of electricity from the machine in one direction only. The direct current of electricity is transmitted through the coils of a tangent galvanometer, and as each additional magnet is placed upon the magnet-cylinder, it is found that the quantity of electricity generated in the coils of the armature is very nearly in direct proportion to the number of magnets thus applied.

Experiments were also made to find out what relation existed between the sustaining power of the permanent magnets on the magnet-cylinder and that of an electro-magnet excited by the

electricity derived from the armature. When four permanent magnets capable of sustaining 40 lbs. and the sub-magnets were placed in metallic contact with the poles of the electro-magnet, a weight of 178 lbs. was required to separate them. With a larger electro-magnet, not less than 1,080 lbs. was required; that is, the electro-magnet had an attractive force twenty-seven times greater than the combined force of the four permanent magnets. It is further found that the power of the electro-magnet may, in the same manner, be indefinitely increased.

By experimenting with electro-magnets of various sizes, it was found that when the wires forming the polar terminals of the magneto-electric machine were connected with a large electro-magnet but a short time, a spark could be obtained from the electro helices twenty-five seconds after such connection had been broken. Hence, Mr. Wilde infers that an electro-magnet possesses the power of accumulating and retaining a charge of electricity similar but not identical with that which is retained in insulated submarine cables, and in the Leyden jar.

It may here be remarked that the discovery of the accumulating and retaining power of an electro-magnet is not new: it was long since demonstrated in this country by experimenters who had constructed large electro-magnets, under the impression that the same results would follow with them as with small magnets, and large sums of money were expended before it was ascertained that the time of the demagnetizing a magnet increases with its size.

Mr. Wilde then proceeded to ascertain whether a proportionately large amount of dynamic electricity could be evolved by a large electro-magnet excited by a small magneto-electric machine. Two magnet-cylinders were made, having a bore of two and a half inches and a length of twelve and a half inches. Each cylinder was fitted with an armature, round which was insulated copper wire 0.15 of an inch in diameter and sixty-seven feet in length. Upon one magnet-cylinder sixteen permanent magnets were fixed, and to the sides of the other magnet-cylinder was bolted an electro-magnet, formed of two rectangular pieces of boiler-plate enveloped with coils of insulated copper wire. The armatures of the two and a half inches magneto-electric and the electro-magnetic machines were simultaneously driven with an equal velocity of 2,500 vibrations per minute. When the electricity from the magneto-electric machine was transmitted directly throug a piece of

No. 20 iron wire .04 of an inch in diameter and three inches long was made red hot, but when the current from the magneto-electric machine was sent through the coils of electro-magnetic machine the electricity from the latter melted eight inches of the same sized wire and a length of twenty-four inches was made red hot. When the electro-magnet of a five inch machine was excited by the two and a half inch magneto-electric machine, the electricity from the former melted fifteen inches of No. 15 wire .075 of an inch in diameter.

Mr. Wilde then constructed a ten inch electro-magnetic machine; the electro-magnet weighs about three tons, and the weight of the whole machine is about four and a half tons. It has two armatures, one for producing "intensity" and the other "quantity" effects. The intensity armature is coiled with an insulated conductor consisting of a bundle of thirteen No. 11 copper wire, each 0.125 of an inch in diameter. The coil is 376 feet in length and weighs 232 lbs. The quantity armature is enveloped with the folds of a copper plate conductor (insulated), sixty-seven feet long and weighing 344 lbs.

These armatures are driven at a uniform velocity of 1,500 revolutions a minute by means of a wide leather belt of the strongest description. When the direct current from the one and five-eighth inch magneto-electric machine, having on it six permanent magnets, was transmitted through the five inch electro-magnetic machine, and the current from the latter was sent through the ten inch electro-magnet, an amount of magnetic force was developed in the large magnet far exceeding anything heretofore produced, accompanied by an evolution of dynamic electricity from the quantity armature so enormous as to melt iron wire .15 of an inch in diameter and fifteen inches in length. The same arrangement melted fifteen inches of copper wire 0.125 of an inch in diameter. When the intensity armature was used the electricity melted seven feet of wire 0.065 of an inch in diameter, and made red hot twenty-one feet of the same kind of wire, but the illuminating power from this armature is the most brilliant description. When an electric lamp was used having gas-carbon pencils one-half an inch square, and placed on the top of a high building, the light evolved was sufficient to cast shadows from the flames of street lamps a half a mile distant. Sensitized photographic paper exposed to this light, at a distance of twenty-five feet, for only twenty seconds, was dark-

ened as much as the same paper would have been if exposed to the sun's rays for one minute.

The production of these remarkable effects from electricity first generated in six magnets weighing only one pound each, is not obtained without a corresponding expenditure of mechanical force, for it was found the large electro-magnet could be excited to such a degree that the strong leather belt was scarcely able to drive the machine.

The author by these experiments shows the remarkable analogy between the operation of the static forces of magnetism and of cohesion in modifying dynamical phenomena, which throws additional light on the nature of magnetic force. The author concludes from his varied experiments that magnetism is a mode of the force of cohesion, or is, if the term be allowed, polar cohesion acting at sensible distances, the equivalent of magnetic force being obtained at an expense of an equivalent of ordinary cohesive force (in an axial direction), so long as the iron continues to be magnetised.

Production of Frictional Electricity in Increased Quantities.

Mr. Holz has, by means of the Franklin electric machine, manifested the same principle, illustrated by Mr. Wilde. A varnished glass plate is revolved very near another plate having two or more pieces of cord attached which are electrified by a piece of rabbed, glass or ebonite, at the same instant a resistance is felt by the person turning the handle of the machine, and this electrization of the cord converts into a continuous stream of intense electricity the force expended by the operation.

Disinfectants.

The discussion on the selected subject was opened by Dr. L. Feuchtwanger, who gave an interesting account of various methods for disinfection, several of which he had himself used. In conclusion, he read extracts from a very able paper on this subject, which appeared in the *North British Review* for June, 1865.

Dr. L. Bradley presented the following paper on

Disinfectants, Malaria and Malarious Diseases.

So far as disinfectants can be made available in the promotion of health, it is of the first importance that we understand them and know how to use them.

The etiology of malarious and pestilential disease is a topic of the greatest moment, which, in proportion to its importance, has

engaged the attention of the learned in all ages; and yet the subject is an open one, and seems to be as far from being settled as ever.

For some forty years of my life I have lived in truly malarious districts, and have seen and felt much of the intermittents and the thousand concomitant forms of diseases, having their origin in the malarious influences, be its intrinsic or essential nature whatever it may. Under the observation and experience thus derived, an hypothesis has, for many years, occupied my mind, which is quite at variance with the several theories usually supported, all of which assume the presence of some specific poison, or deleterious matter in the atmosphere.

This hypothesis consists in the supposition that malarious diseases are produced, not by any specific poison in the atmosphere, originating from the decomposition of vegetable matter, or any other generating agency, or from the existence of effluvia, or miasmatic emanations of any kind, but from a cause which may be considered as *negative* in its character, viz., the want of the normal depuration of the animal organism.

It is well known that all the tissues are continually undergoing change, by assimilation and defecation. The matters, therefore, which have served their purpose and become effete, must be regularly expelled, or they act as a virulent poison, and readily become the occasion of great and general disturbance.

Among the most important of the functions, by which the depurative process is performed, is that of perspiration. The exhaling vessels of the skin are ordinarily capable, by their vital energies, of presenting the perspirable matters to the surface, and, under the stimulus of either great warmth or exercise, of actually throwing them out in the form of sweat; but in the absence of such stimuli another auxiliary is required, viz., an atmosphere having an affinity for the exhaling matters. In a healthy state of the atmosphere, such affinity is an active, positive force of great power, but it may be stated in various ways, the most simple and common of which perhaps is the evaporation of simple water, which sometimes occurs to such an extent that the temperature of the atmosphere and the dew point are brought to close approximation to each other; hence the well known danger of being in the open air when the due is forming around us.

An excess of carbonic acid, too, has a powerful effect in satisfying the appetency with which the atmosphere is otherwise endowed,

of imbibing, taking up and carrying off the effete carboniferous matters, which, by the vital action, are presented at or near the surface.

During the spring and early summer, while vegetation is growing luxuriantly, carbon is assimilated and the atmosphere is purified; but later, when plants begin to decline in their growth, the air becomes charged, in greater proportion, with carbonic acid. To this, and to the fact that in the latter part of summer and in the fall the atmosphere is more highly charged with aqueous vapor, is due to the greater prevalence of malarious diseases in the fall of the year than in the spring.

In crowded and badly ventilated hospitals, ships, prisons, &c., the air sometimes becomes charged to repletion with the very matters which have already served their purpose in the animal economy, whereby disease of malignant type is generated.

These matters, it may be true, when taken into the lungs by inspiration, are, in some degree, poisonous; but their deleterious effects, in this respect, are next to nothing, compared with those occasioned by their effect in depriving the air of its tendency of absorbing and carrying away the exhaling matters.

I conclude, therefore, that malarious diseases (not including the contagious) are not caused by the exterior poison taken into the system, but by interior effete excrementitious matters, which have become poisonous, of which the system has failed to be properly depurated, on account of the lack of a good dry atmosphere, having affinity or appetency for such excretions, and the consequent depuration of that very important auxiliary in the performance of perspiratory function.

And now for the remedies, the disinfectants; and what are they? I answer, anything that has a tendency to desiccate, or dry the air, or to enlarge its capacity of absorbing and dissolving the fluid of perspiration—thereupon "fire," as was quaintly remarked at our last meeting, "is the best disinfectant."

The immunity from malarious attacks enjoyed by persons whose calling keeps them much under the influence of artificial heat is proverbial. Fire greatly increases the power of evaporation in the atmosphere.

Chloride of calcium and other deliquescent salts, owing to their strong attraction for moisture, tend to dry the air, and are, so far, good—but they are costly and inefficient as compared with a little fire. The common practice, therefore, of taking down stoves and

removing all facilities for house-warming, for four or five months in the year, especially in malarious regions, I condemn in toto. There is not a summer month in which there are not times of humid atmosphere, in which a little fire, made up at evening, would not be beneficial.

There is yet another powerful disinfectant. I mean a little water (cold water is preferable), with the addition of a little soap, if need be, applied at proper intervals, by way of ablution, which, being followed by thorough rubbing with a dry crash, opens the pores and stimulates the skin to healthy action in the performance of its excretory function.

Such, Mr. President, is a brief outline of a theory by which I have been able to account more satisfactorily to my own mind for malarious phenomena, under all the varied circumstances attending them, than by any other.

The chairman remarked that able papers on disinfectants had been published in American medical journals. The paper of Dr. Squibbs, and that of Dr. Allen, deserve especial notice. It was not until the rinderpest had commenced its ravages that this subject commanded much attention in England. Since that time many experiments have been made to determine the best method of checking the disease. A very able report had been made on the subject by Wm. Crookes, F. R. S., of London, editor of the *Chemical News.*

Carbonic or (phenic) acid has been found very efficacious in arresting the cattle plague.

Prof. Chas. A. Joy said that out of the number of disinfectants that have been discovered, carbolic acid is perhaps the one we ought to retain. It is a substance that has a wonderful effect in destroying animal life. It is astonishing to see how insects will fly from it. It is amusing to observe how a heap of insects that are torpid, when this acid is brought near them in a moment they will turn out alive and leave the spot. It is a very violent poison; a very small quantity of it is sufficient to kill a dog. Phenic acid is almost identical with creosote. We have had a great many things suggested for disinfectants; among these sun-light has been highly spoken of. Persons who live much in the sun-light are more healthy and live longest. A system of sun bathing has been tried with good effect, where persons are exposed for hours to the light of the sun, entirely naked. This is a simple and a cheap process, and doubtless the best.

After deciding to continue the discussion of this subject, the Association adjourned.

AMERICAN INSTITUTE POLYTECHNIC ASSOCIATION,
October 25, 1866.

Prof. S. D. Tillman in the chair; T. D. Stetson, Esq., Sec'y.

The chairman presented the following extracts from scientific papers:

DISINFECTION IN CONNECTION WITH THE CATTLE PLAGUE.

Disinfection, in the sense in which it is used here, implies the destruction of animal poison, in whatever way it is accomplished. To find a perfect disinfectant for the cattle plague poison would be to stop the disease at once. We have naturally been very desirous of discovering a substance with such a power; but much more evidence is necessary before we can venture to affirm that success has been obtained. In the first instance we requested Dr. Angus Smith to undertake this subject, with a view of seeing what chemical agent would be best suited for the purpose. Subsequently, at his suggestion, Mr. Crookes was asked to carry on various practical trials which might test the efficacy of two agents which Dr. Angus Smith had reported to us as likely to be useful. We refer to the reports of these two gentlemen for an explanation of the present doctrines of infection, and an enumeration of the different substances which may be used to destroy the poison. On examining these different agents it is soon found that the number of those which can be employed with advantage is limited. Since the poison is constantly given off in discharges flowing from diseased surfaces, and since it may be suspended like impalpable dust in the air, it becomes necessary that any disinfectant should act continuously both on the discharges and on the air. No disinfectant can be efficacious if its action is intermittent, or if it does not act on both sources of danger. It is evident indeed that the poison ought to be destroyed at the very moment of evolution or discharge. Every minute during which it remains active increases the danger. The disinfectant must therefore not only be both fixed and volatile, but so cheap and easily used as to be continually in action, and it must of course be innocuous to cattle and men. A large number of substances which can be used in many other cases as disinfectants, must be put aside, as not meeting these necessary conditions. Compounds of iron, zinc, lead, man-

ganese, arsenic, sodium, lime, or charcoal powder, and many other substances, want the volatile disinfecting power; iodine, bromine, nitrous acid, and some other bodies are too dear, or are entirely volatile, or are injurious to the cattle. On full consideration, it appears that the choice must lie between chlorine, ozone, sulphur, and the tar acids (carbolic and cresylic). Two of these bodies, viz: chlorine, in the shape of chloride of lime and the tar acids, have the great advantage of being both liquid and aëriform; they can be at once added to discharges, and constantly diffused in the air. All these four substances—chlorine, ozone, sulphurous acid, and the tar acids—have been practically tested, either in England or on the Continent, and there is considerable evidence that they all actually do destroy the cattle plague poison. Their precise mode of action is still uncertain. Chlorine and ozone act, no doubt, as powerful oxidisers, converting animal poisons into simple and innocuous substances. Sulphurous acid probably destroys the virus by its strong antiseptic powers. The tar acids, according to the experiments of Mr. Crookes, neither interrupt nor accelerate oxidation, but they act most powerfully in arresting all kinds of fermentative and putrefactive changes, and annihilate with the greatest certainty all the lower forms of life. After a full consideration of the relative merits of the four disinfectants, and after some practical trials, Mr. Crookes arrived at the conclusion that the most powerful, and at the same time most simple process of disinfection, would be to use the tar acids as constant liquid and aëriform disinfectants, and sulphur in the form of sulphurous acid as an additional and occasional agency.

In our first report we recommended both these agents in a state of combination; the best mode of using them in a free state will be found detailed in Mr. Crookes' report, and in the instructions which we furnished to your Majesty's Government in February last, and which will be found in the appendix. The general result of the experiments on disinfection with carbonic acid and sulphur is certainly very encouraging. For the details of these experiments, which have been careful and searching, we refer to Mr. Crookes's report. It is of course most desirable that no false hopes should be raised, for we have seen but too many instances in which a rude disappointment has utterly crushed what seemed reasonable expectations. But no one can peruse the account of what has been done without seeing that a fair case has been made out for a large and systematic trial of these measures. They must,

however, be fairly tried; they must be used with perseverance and energy; not grudgingly or insufficiently, as has sometimes been the case, but with the determination to keep the disinfectant in presence of the poison everywhere and constantly, so that every particle of virus may be, without fail, subjected to its action.

For the reasons stated in Mr. Crookes' report, it appears that chloride of lime is inferior to the combined use of carbolic and sulphurous acids. But there is no doubt of the efficacy of this agent, and in certain circumstances, as for the washing of railway trucks, it may be employed in addition to boiling water or steam. It is very desirable that the use of carbolic acid should become general throughout the country in uninfected as well as in infected districts. There is little doubt that even were there no danger from the cattle plague, the great purifying effect of this substance on the air of cattle sheds, would contribute greatly to the health of the animals. *Third Report of the Royal Commissioners on the Cattle Plague.*

The Use of Phenic Acid.

A paper was lately read at the meeting of the Academy of Sciences, by M. Lemaire, who ascribed extraordinary properties to this acid, which is one of the results of the volatile distillation of coal-tar. He stated that anatomical specimens and entire animals might be preserved, in a fresh condition, in vessels smeared over on the inner surface with phenic acid, provided that the vessels are hermetically sealed, so as to prevent the removal of the air contained in them. The bodies of animals injected with phenic acid, dissolved in water, may be kept without any alteration by the contact of atmospheric air. In this manner, the body of a man might be preserved at a very trifling expense.

Disinfecting and Deodorizing Compounds.

1. *Sir William Burnett's Patent Solution.*—It is made by dissolving zinc in commercial muriatic acid to saturation.

2. *Ellerman's Deodorizing Fluid.*—This consists chiefly of perchlorides and chlorides of iron and manganese.

3. *Ledoyen's Solution.*—This is a solution of nitrate of lead, and contains about 20 oz. of the salt in a gallon. The specific gravity should be 1.40. A similar compound may be made by mixing 13½ ozs. of litharge with six pints of water, and adding

12 ozs. of nitric-acid at 1.38 specific gravity (or 8 oz. at 1.50); and digesting at a gentle heat till the solution is complete.

4. *Siret's Compound.*—Sulphate of iron 20 lbs.; sulphate of zinc $3\frac{1}{4}$ lbs.; wood or peat, charcoal 1 lb.; sulphate of lime $26\frac{1}{2}$ lbs.; mix and form into balls. To be placed in cesspools, etc., to deodorize them. M. Siret has subsequently modified this compound, thus: sulphate of iron, 100 parts; sulphate of zinc, 50; tan, or oak-bark powder, 40; tar 5; and oil, five parts.

5. *Collins' Disinfecting Powder.*—Mix two parts of dry chloride of lime with one of burnt alum. To be set in shallow dishes in rooms, etc., with or without the addition of water.

A Valuable Secret.

The *Scientific American* says: "The unpleasant odor produced by perspiration is frequently a source of vexation to persons who are subject to it. Nothing is simpler than to remove this odor much more effectually than by the application of such onguents and perfumes as are in use. It is only necessary to procure some of the compound spirits of ammonia and place about two tablespoonsful in a basin of water. Washing the face, hands and arms with this, leaves the skin as clean, sweet and fresh, as one could wish. The wash is perfectly harmless, and very cheap. It is recommended on the authority of a physician."

A Pleasant Mouth Disinfectant.

A writer in the *Dentist*, Leipsic, 1866, gives the following formula for a corrective of the bad odor from decayed teeth, which he suggests may prove to the dentist cleansing them, and the individual suffering from them, a source of cholera. Formula: Hypermanganate of potassa and hyperoxydate of barium, of each twenty-four grains, one-half to be rubbed up into a mass, with sugar and glycerin, and divided into 144 lozenges. Every ill-smelling mouth will become, by their use, perfectly odorless.—*Medical Record.*

New Test for Acids and Alkalies.

Owing to its property of being reddened by acids and turned blue by alkalies, prepared litmus is perhaps the most generally useful of all the chemical tests which have been hitherto known. A test of a similar nature, but very much more sensitive than litmus, has recently been found by Scöhnbein, to be furnished by

the artificial blue coloring matter obtained by acting on chinoline with iodide of amyl, and known as "cyanin." This body is so readily acted upon by acids and bases, and its tinctorial power is so enormous, that its delicacy as a test for either acids or bases is quite marvellous. It will detect the presence in water of one-millionth of either sulphuric acid or caustic potash, and of quantities of carbonic acid which cannot be detected by means either of limes or of barytes. Pure distilled water colored with it so as to be quite blue while preserved from contact with the atmosphere, has its color instantly destroyed by being blown into from the lungs, by reason of the carbonic acid in the expired breath. Magnesia is incapable of dissolving in water to a sufficient extent to enable the solution to react upon litmus, but pure water in which magnesia has been shaken up gives a most distinct alkaline re-action with cyanin. So does distilled water which has had oxyd of lead shaken up in it, albeit sulphureted hydrogen, which will detect one part of lead in 350,000 of water, is incapable of showing that any oxyd of lead has been dissolved.

Kreosote and Carbolic Acid.

Prof. A. W Hoffman, now at Berlin, has shown quite recently that these two substances, the one obtained from vegetable, the other from mineral tar, are essentially identical, and do not, as has hitherto been very generally assumed, possess different re-actions. Still the kreosote of wood used in medicine must not be replaced by carbolic acid, since it is now proved to contain some admixtures which the latter acid does not have.

Transformation of Nitrate of Soda into Nitrate of Potash.

M. Condurie has patented the following processes. He makes concentrated and equivalent solutions of nitrate of soda and chloride or sulphide of barium, and mixes the solutions. Nitrate of baryta, which is but sparingly soluble, is precipitated. It is well washed and then boiled with sulphate of lead, whereby nitrate of lead and sulphate of baryta are produced. The nitrate of lead is now boiled with sulphate of potash, and so nitrate of potash is formed and sulphate of lead reproduced.

Process for the Condensation of Ammoniacal Gas.

Knab has found that chloride of calcium absorbs its own weight of ammoniacal gas, which is again evolved on the application of heat. The chloride will serve an indefinite time. M. Knab con-

siders that his discovery will be found very useful. 1. Because chloride of calcium saturated witn ammonia is dry powder, easy of transport. 2. Because chloride of calcium is of very little value ; and 3, while water will only hold in solution twenty per cent. of ammonia, the chloride will hold fifty per cent, so that the cost of sending ammonia about will be greatly diminished.

Peroxyde of Hydrogen.

Prof. Schönbein has discovered a new and very ready method of procuring the peroxide of hydrogen. It consists simply in agitating in a large flask, to which air has access, amalgamated zinc, in powder, with distilled water. Oxygen is then absorbed by both the zinc and the water, with formation of oxide of zinc and peroxyde of hydrogen. The peroxyde of hydrogen obtained by this method, unlike that obtained by the ordinary process, is quite free from acid, and so may be kept for a long time without decomposition. It does not contain, moreover, a trace of either zinc or mercury, but is absolutely pure. This new process has, therefore, great advantages over the old process of preparing peroxyde of hydrogen, both as being far simpler and more expeditious, and as yielding a much purer product; but it is almost as far as the old process from yielding peroxyde of hydrogen cheaply enough for use in the arts.—[*Mechanics' Magazine.*

Pyrotechnics.

A correspondent of the *Chemical News* says : On looking over a number of receipts, collected among my earlier days of chemical experimenting, I came upon a number of original receipts for colored stars, for rockets, Roman candles, and shells, which, as they were the result of many experiments, I can confidently recommend as very brilliant in color and good, and I venture to hope that not only amateurs, but even some professional pyrotechnists may find the receipts serviceable, for even in professional exhibitions some of the colors are often sadly wanting in brilliancy.

The ingredients for each of these stars, for rocket heads, &c., is powdered separately, and then the whole is made up into a thick paste, with water, which is rolled out to the proper thickness, and punched into square stars and carefully dried till quite hard.

1. Red Stars.—Dried nitrate strontia, 4; chlorate potash, 2; sulphur, 2; black sulphide antimony, 1.

2. Green Stars.—Nitrate baryta, 5; chlorate potash, 2; sulphur, 2; black SbS_2.

3. Lilac Stars.—Chlorate potash, 49; sulphur, 25; chalk, 20; black CuO, 6.

4. Purple or Blue Stars.—Chlorate potash, 42; pure nitrate potash, 22; sulphur, 22; CuO, 10.

With regard to the remaining receipts I am not able to state whether they are original or not at this distance of time; still, as they are all well proved, I venture to send them, if they will not take up too much room in your journal.

5. White Stars.—Saltpetre, 16; sulphur, 4; black sulphide antimony, 5.

Blasting powder at 6d per lb., reduced to powder is meant in the following receipts:

6. Tail Stars.—Blasting powder, 8; sulphur, 8; saltpetre, 8; coarse charcoal, 8.

Charge for 2 oz. Rockets.—Blasting powder, 20; charcoal, 6; saltpetre, 4. A moderate amount of blasting powder for the head to light and disguise the stars.

Composition for Roman candles between the stars lying on powder at 1s. 3d. per lb. Saltpetre, 5; blast powder, 1½; sulphur, 1; sand, 1.

Spur Fire.—Saltpetre, 4½; sulphur, 2; finely powdered and mixed, and then gently rubbed with lampblack, 1½; pack in cases six inches long and three-quarters internal diameter.

Proportion of Oil in Various Seeds, &c.

Munch exhausted the materials with ether, and gives the following as the percentages of oil in the various substances:

	Per cent.
Sweet almonds	55.4
Bitter almonds	52.0
Poppy seed	49.4
Hemp seed	35.5
Cacao	47.4
Linseed	29.6
Mustard	31.8
Croton seed	43.4
Castor seed	46.0
Laurel berries	31.8
Mace	25.5

	Per cent.
Walnuts	64.8
Hazel nuts	59.4
Cotton seed	18.4
Eggs	27.8

What is Saleratus?

Wood is burnt to ashes, are lixivated, and ley is the result. Ley is evaporated by boiling, black salt is the residuum. The salt undergoes purification by fire, and the potash of commerce is obtained. By another process we change potash into pearlash. Now put these in sacks and place them over a distillery mash-tub, where the fermentation evolves carbonic acid gas, and the pearlash absorbs it and is rendered solid; the product being heavier, whiter and drier than the pearlash. It is now saleratus. How much salts of ley and carbonic acid gas one can bear and remain healthy, is a question for a saleratus eater. Some people say saleratus will not harm the stomach. It is a *ley*.

Beefsteak Crusher.

This machine, invented by J. J. Doyle, of Sharon, Conn., was exhibited. It consists of two iron rollers covered with teeth, between which the meat is to be drawn, previous to its being cooked, in order to make it tender. It is designed to do the work generally accomplished by pounding the meat.

Dr. Bradley thought there would be difficulty in cleaning the toothed rollers after each use of it. The cleaning would have to be thorough, carrying off all traces of the fluids from the meat.

Card Holder.

Mr. A. A. Marks exhibited a card board on which were a series of buttons, held by springs on the back side of the board, and so arranged as to clasp tightly any cards that were placed partly under them. The board would hold a very large number of business cards, and would be useful to a merchant.

Feathered Paddle Wheel.

Mr. Hicks exhibited his plan of a feathered paddle wheel, which he claimed required less parts than those now in use. In other wheels there were joints to each paddle. In this only two joints were required for the whole wheel.

Mr. Norman Wiard thought that chips of wood would be apt

to get in between the gearing, and soon put it out of order. An attempt has been made to propel vessels by a series of buckets attached to an endless chain, by which a number of the buckets are always acting on the water. But there was no advantage in this method, as it is only the first bucket that has any effect; but with the ordinary paddle wheel, it acts on the water from its first entering to its leaving the water.

New Combination of Cranks.

Dr. Rowell exhibited a model showing how by the addition of a third crank, thus making a triangular connection, the beam of a vertical engine in a steam ship could be lowered as the vessel became lighter by the consumption of coal.

The exhibition of this model led to a very interesting discussion regarding the kind of engines best for steamships, and the proper ballasting of the vessel, in which Dr. Rich and Mr. T. D. Stetson took a prominent part.

Disinfectants.

The chairman opened the discussion of this subject with the following paper:

Disinfectants, in the widest sense of the term, embrace all substances employed to destroy or counteract the effects of all external impurities which are sources of disease. Deodorizers are not necessarily disinfectants. Deodorizers may dissipate a smell, or merely disguise it, by a more powerful and agreeable one. Perfume is a palliative. Thus musk may mask or drown a disagreeable odor, and a scented handkerchief may cover a multitude of noxious emanations. True, disinfectants produce a more important change. They attack and rout the unseen and insideous enemies of health. Contagious diseases, not the result of direct contact, are supposed to be transmitted by a virus floating in the air, which is too small to be seen even with the aid of the most powerful microscope, and too subtle to be detected by the most careful chemical analysis. This unknown virus is the offspring of a morbid process, and is probably a zymotic organism, possessing vitality. It certainly has the power of increasing, by reproduction or by growth, with fearful rapidity. No remedy has yet been found for the cattle plague still raging in England, and as yet no infallible antidote is known for the cholera that at present infests both the old and the new world. When a contagion, for which there is no specific cure, is rapidly spreading, the only recourse left is to pre-

vent its progress by the use of disinfectants. There is no royal road to safety in such a case, for the medium of contagion is the atmospheric air, the common reservoir from which all classes, the good and bad, the wise and ignorant, the rich and poor, alike draw at every breath their quota of oxygen, it seems a self-evident proposition that the whole community are or may be, sooner or later, equally interested in the efficaciousness of disinfectants.

The ancients erroneously supposed there were but four elementary substances, earth, water, air and fire. We may, however, take these simple divisions as types of the different processes of disinfection.

First. Earth acts as an absorbent of liquids and gases. At the head of the solid absorbants stands charcoal, which not only collects and retains noxious gases, but brings them into such close contact that their decomposition is hastened. Fresh burnt lime, when slacked by water, will combine with not less than eighty times its bulk of carbonic acid gas, giving off at the same time the water absorbed in slacking, thus overcharging the air with moisture.

Second. Water, as the great solvent, which, in the process of washing, carries off in solution many noxious compounds.

Third. Air, as the great purifier by substitution. Fresh air, displacing foul air in the process of ventilation, constantly bears away deleterious exhalations, until the cause of action has been exhausted.

Fourth. Fire, the result of oxidation, may be taken as the type of purification by rapid chemical changes. Under this head the most efficient disinfectants should be enumerated. Air is cleansed by abstracting its impurities, or changing their character by disinfectants, which either decompose noxious bodies, or combine with such bodies so as to form new and harmless substances.

The most powerful disinfectants are gaseous. By the law of diffusion, they are borne very rapidly and equally into every part of the foul air, and reach the innermost recesses of its hiding places. Furthermore, they are strongly electro-negative when consisting of a single element.

The chairman concluded by reference to an interesting extract from a foreign paper, which was then read by Dr. J. B. Rich.

Dr. L. Bradley said that anything that tends to dessicate or dry the air, or to enlarge its capability of absorbing and dissolving the fluids of perspiration, is a true disinfectant. Fire increases the power of evaporation. Chloride of calcium and other delequescent

salts, by their attraction for moisture, tend to dry the air, and hence stand so high as purifiers. By the application of water, the pores of the skin are opened, and thereby healthy action in the performance of its excretionary functions is stimulated.

Mr. J. K. Fisher inquired if there was not some merit in the plan proposed in Paris, of drawing the air from the sewers of that city, and passing it through the chimneys of the large factories. The air of hospital rooms should be made to pass into our large chimneys, and not let out into the air.

Mr. L. B. Page stated that where he lived in Indiana, some thirty years ago, most of the houses were built on a high mountain there, and it was found that there the most malarious diseases prevailed. This gave rise to much discussion, and it was found that the malaria ascended from below to the top of the hill, for those midway on the hill were free from the disease.

Dr. J. B. Rich said that malaria makes its way up a hill in the night time. The sun heats the earth during the day, and at night the cold strata of air above will press down and force the warm air up.

After some further discussion of the subject the Association adjourned.

AMERICAN INSTITUTE, POLYTECHNIC ASSOCIATION,
November 1, 1866.

Prof. Samuel D. Tillman in the chair; T. D. Stetson, Sec'y.

IMPROVED GAS BURNER.

Mr. Simmons exhibited a new gas burner. The arrangement of the interior is such that the gas passes through a wire gauze, and thus becomes heated; it then passed through a large chamber before reaching the aperture which admits it to the air. Heating the gas and allowing it to expand, seemed by the experiments then made, to produce more perfect combustion. The intensity of the light from this burner was much greater than from a common burner using the same quantity of gas.

IMPROVED BOILER.

Mr. J. Wyatt Reid exhibited a model and drawings illustrating the construction of his boiler, which contains about twice the heating surface of an ordinary upright boiler. Instead of allowing the heat to escape at the top, it is passed downward and then upward.

The inventor claimed that it was fifty per cent stronger than the common upright tubular boiler.

The chairman then presented the following items of scientific news:

The Torpedo in Oil Wells.

Col. E. A. S. Roberts has been successful in the use of his torpedo. Hundreds of oil wells in Pennsylvania had ceased to flow, and the only alternative left in such cases seemed to be to bore again in the same vicinity. Col. Roberts, believing the stoppage of a well was owing to an accumulation of paraffine, debris, and other clogging matter at the bottom, conceived the idea of removing it by means of an explosive compound. Nitro-glycerin (*echarlineot*) having far greater explosive force than gunpowder, and being easily used in presence of water was found to be admirably adapted for such a torpedo. Its explosion in a well where oil had failed to flow has the effect of clearing out the old channels and perhaps of opening new apertures, so that in many cases the old well has nearly equalled its first yield. Out of 200 wells operated on by the torpedo within the last four months, about fifteen now flow from 60 to 250 barrels per day; about 130 have been improved to the extent of from five to 100 barrels increase daily. On the average three out of every four wells experimented upon have been greatly improved. Thus the torpedo has been the means of increasing the quantity of oil produced more than four thousand barrels daily, and of adding to the revenue of the oil region at the rate of at least 5,000,000 of dollars per annum.

Alcohols Containing Silicon.

The *Comptes Rendus*, of Paris, describes the interesting process by which Messrs. Friedel and Crafts have succeeded in replacing a portion of the carbon in certain alcohols by silicon. Silicium ethyl $(C_2\ H_5)_4$ Si-(*echalomak*)-is subjected to the action of chlorine which replaces one and two atoms of hydrogen. The resulting products are heated in a closed tube with acetate of potash and alcohol. Among the products formed is a liquid which boils between 208° and 214° C, and has a faint acetic and ether-like smell. In burning it is luminous, giving off white fumes of silicic acid (*aket*). Its formula is Si $C_8\ H_{19}\ (C_2\ H_3\ O)$ O and is formed by the replacement of chlorine by oxacetyt in monochlorinated silcium ethyl. When this body is subjected to caustic potash (potamalt) dissolved in alcohol, a new liquid is formed which

boils at 190° C. It is the hydrate of the radical Si C_8 H which the authors call silicononyl. According to the new chemical nomenclature, its name is *eichilak*.

Action of Light upon Iodide of Silver.

M. Carey Lea, in a paper on this subject in the American Journal of Science and Art for September, gives a statement of various experiments, and concludes that the action of light upon pure isolated iodide of silver cannot be a chemical reduction, because,

1st. That effect, when carried many hundred thousand times further than in the ordinary photographic process, perfectly disappears in a few days, spontaneously, under circumstances which render it impossible to suppose that iodine could have been restored to replace that which (had the reduction taken place) must have been disengaged.

2d. Even when the action of light is prolonged many hundred thousand fold the ordinary time, no reduced silver nor sub-iodide can be detected as at present.

3d. He has shown that another metal, mercury, is capable of developing images as well as silver.

4th. He had endeavored to show that a purely physical cause, to wit, mechanical pressure, is capable of producing a developable impression, thereby answering the objection of the inadequacy of a physical influence to create a basis of development.

5th. Although the chemical theory is supported by some distinguished chemists of the present day, he was not aware that a single well verified experiment had been brought forward in support of that view.

Color of a Diamond.

Fremy exhibited before the French Academy of Science a yellowish diamond, which on being heated changes its color to rose red; this it retains for two or three days, and gradually resumes the light yellow. This peculiarity has increased its value to three times that of the colorless gem of the same size. It is held at $36,000.

Heat Absorbing Power of the Vapor of Water.

The report of the experiments of Magnus, published in Poggendorf's *armalen*, has thrown new light on this subject. Tydall, in his lecture on radiation, had ascribed to watery vapor great absorbent power, and asserted that the power of a single mole-

cule of vapor was many thousand times that of an atom of ether. Magnus shows this remark is only true in regard to fog or foggy vapor. By means of his very delicate thermo-multiplier he found the heat radiated by certain gases and vapors, at about 230° C., which is proportional to their absorptive power, to be as follows:

Dry atmospheric air, ...	3 M. M.
Air after passing through water	3 to 5, M. M.
Air after passing through boiling water.	20 M. M (the maximum).
Air through water boiling so strongly as to produce visible fog at the radiating point	100 M. M.

This was the result of a gradual increase of heat. Radiation of carbonic anhydride (garet), from 100 to 120 M. M. Common illuminating gas about the same.

Mr. Norman Wiard exhibited and explained the action of the Prussian needle gun, Spencer's repeating gun, and Sharpe's breech-loader; after which he presented the following paper:

Breech Loaders and the Prussian Needle Gun.

At the beginning of the late war, the highest position in our ordnance department was occupied by an officer who believed and asserted, "that a Harper's Ferry model smooth-bore musket, with buck and ball, was the best arm and ammunition for infantry." He considered the Springfield rifle an *innovation*, and expected the experience of a war would condemn it. While such views were extant, in the department charged with procuring arms for troops, it was, of course, impossible to introduce any improvements; and the policy thus inaugurated prevailed nearly throughout the war—during which time, however, a large number of breech-loading arms were invented and offered to the government.

Officers, in command of troops in the field, noticing that muzzle-loading muskets were disabled after about twenty rounds, because they would become so foul that the next cartridge could not be got down, united with the inventors in laying the question before President Lincoln, who attempted, by giving an order to the ordnance department, to have the troops supplied with breech-loaders; but was deterred when shown that no such arms were on hand, and that a sufficient number could not be procured within a reasonable time. In the meantime the ordnance department continued to urge the manufacture and purchase of muzzle-loaders.

The first breech-loaders were furnished to regiments or flank companies, by the direct order of the President; when some inventor or manufacturer, who had produced a thousand or less number at his own risk, and without an order, managed to have the co-operation of a colonel, and the approval of a general, to back up his application to Mr. Lincoln for their purchase and direct assignment to the troops for trial and report.

In this manner a few regiments became supplied with breech-loaders; but such indirect means could not result in giving to the troops the best arms; for the best *wire manipulator* was successful—not the best inventor or manufacturer of arms.

Arms thus adopted, could not have the good qualities of guns as our citizen soldiers deserved to have placed in their hands. Many difficulties were arrayed against the inventor who should endeavor to invent and produce an unexceptionable musket. First and most potent was the want of practical experience in the test of service in the field and in battles. The inventor of the best gun should be at the same time an old soldier and a bright mechanic.

The inventor and producer of the best gun should at the same time be skillful as a mechanic and have capital.

To have the arms so invented and produced into service, the qualities of a politician are necessary; and to all this must be added the right to use the inventions of others; for without interference with the great mass of inventions found in the Patent Office, it would be impossible to make the best gun or the least efficient gun that ought to be placed in the hands of our troops. While it is probably true that no single application in our Patent Office exhibits proportions and devices that would entitle the gun represented to be adopted officially.

Inventors have, as a rule, an aversion to adopt or advocate the inventions of others, and I think our patent laws are deficient in this point, viz: That no protection is given to the inventor and manufacturer who produces, from what is known, a new combination, having the required qualities and proportions for an efficient arm.

I have here a Russian needle gun that, in my opinion, exhibits the elements of rare qualities for an efficient breech-loading rifled musket for infantry.

It was imported from Europe by Messrs. Tiffany & Co., and is said to have been picked up on a battle field by an Austrian soldier; whether this story is true or not, I consider of but little interest to this Club.

Its great weight gives good resistance to the recoil. If we should use a gun no heavier than the bullet, the gun would recoil as far as the shot would be projected. The gun that offers greatest resistance by its *vis-inertia*, other things being equal, to recoil, projects the bullet farthest. Its whole length, from the shoulder to the muzzle, is great, and it is heavy at the muzzle, by which two advantages or more are obtained, viz: The muzzle sight is separated a greater than usual distance from the eyes, and from the re-inforce sight, by which better aim can be had; and the weight of the muzzle gives great steadiness to the aim. These qualities will be best appreciated by those who aim this gun and the Sharp's carbines I have here. The shorter and lighter gun seems too much like a toy, as compared with the needle gun, and yet it is a fair example in these respects of all the American breech-loaders I have seen. The breech attachments of the needle gun appropriate a considerable part of the length of the barrel, which gives it another advantage over guns of similar length, that is, the bullet is not subjected to the friction of sliding along the barrel after the effective expansive force of the powder is expended, which in long guns usually detracts from the initial velocity, and consequently the range of the shot. I consider this quality should not be forgotten, and is one capable of better proportion, almost to perfection. By this I mean that we can, by experiment, determine what is the very best length of the barrel for a given calibre and charge of powder, and then by increasing the length of the breech piece have all the advantage of the long and *steady* gun, with the best range. In the needle gun, we have the elements from which to produce a gun having three forces, either not utilized in other guns at all, or not so well utilized as in this, to eject the bullet and give it velocity, viz: The momentum of the needle striking against the rear of the bullet; the expansive force of the fulminate, which is placed in a cavity at the rear of the bullet, and acts directly to eject the bullet, and the gun having no vent, none of the expansive force of the gases of the powder is wasted.

But it is in the ignition of the powder, at the front end of the cartridge, that we find, perhaps the arrangement of the needle gun most admirable; not wholly in my opinion, because more complete combustion is possible—as I believe is the popular belief in relation to this quality—nor because a larger quantity of powder can be used, although it has that advantage; but because

when a charge is ignited first at the rear, the expansive force is expended in overcoming the *vis inertia* of the grains of powder unconsumed before it, and because the powder is jammed up against the rear of the bullet in the barrel, into so solid and dense a mass that combustion is necessarily slow, and the friction of slipping it, in the form of a dry wad, along the barrel, immense. If we should attempt to drive a tightly fitting bullet along the barrel by striking it blows with a ramrod, we would find the friction of the powder on the surface of the barrel so great, as to render it almost impossible to move it; and the greater the force applied the greater would be the friction. This explanation will enable us to understand why it was found impossible to increase the range of our rifled artillery during the war, by increasing the charges. It is well known that one pound of powder gave the most effective range from a three inch rifled gun. Two pounds would not project the shot more than half as far. On one occasion I found jammed powder adhering to the rear of a shot from a riflled gun, that was projected into a sand bank by a double charge of powder, during some experiments to determine the penetration of rifled guns in sand. This needle gun has some other advantages but I shall not occupy your time longer this evening by referring to them. I do not believe the inventor, or the Prussian government appreciated these I have referred to, else the inventor who peddled it all over the world for twenty years, would have obtained an earlier hearing; and the Prussian army would not have ignored its influence in the late war, as I am informed they do and have done.

Prussian officers attribute their success to the discipline and bravery of the rank and file of the army, and to their skillful commanders.

This gun had undoubtedly much to do with their success; but it must be remembered that the soldiers were drilled with the arm they used. They felt confidence in it; which could not be the case with our army and their arms, for usually their discipline was learned on the battle-field; and they saw their guns first, in many cases, the day they were called upon to use them upon the enemy.

From an official report I learn that more than 27,000 guns were picked up after the battle, on the field of Gettysburgh. Of these 24,000 were loaded; 12,000 with one load each; 6,000 with from two to three loads each; 6,000 with from three to ten loads each. In some as many as six cartridges were found without the paper

being torn. Twenty-two loads were found in one Springfield musket, each load in regular order. Twenty-two balls and sixty-two buck-shot, all mixed up with the powder, were found in one smooth bore musket.

A large number were found with the charge lodged about half way down the barrel; and in many cases the ball was found inserted first. No better argument could be found in favor of breech loaders than this; for no more than one charge can be inserted in a breech loader, and the passage of the bullet along the barrel cleans out the residuum of the preceding charge. The needle gun is horribly practical in all its forms and outlines; and was designed by some one who had none of the appreciation of the beautiful, and *convenient* or *handy*, which is the characteristic of the productions of American mechanics. It is too rough for delicate hands, and in this particular is objectionable. I see in it, however, the qualities I have referred to, which I think cannot be ignored. I hope and expect the United States will soon have an officially adopted arm, equal to this in many points, and better in some.

Experiments in Combustion.

Dr. Vanderweyde exhibited a gas lamp, intended to illustrate some important points in the theory of combustion. It consisted of an Argand burner, with a glass chimney, so arranged as to regulate the amount of air admitted to the exterior of the circular flame, and demonstrating that the amount of light produced is at its miximum when the supply of air is moderate, and diminishes with the increase of the air supply. When the supply is very great, there is little light, but much heat is developed, thus illustrating the principal of the Bunsen burner. When the supply is very small, the gas is imperfectly consumed to carbonic oxyd, and the lamp showed the curious phenomenon of *burning the gas twice*; first, below, to carbonic oxyd, $C\,O$, and second, at the top of the glass chimney, where the escaping carbonic oxyd, meeting a fresh supply of oxygen from the air, was burned with the characteristic flame, to carbonic acid, $C\,O_2$. He illustrated also the manner in which he invented his gas alarm-whistle, by a long glass tube of about one-half inch bore, held vertically, through which a mixture of gas and air passed, and was ignited at the top; by diminishing the supply of gas, or augmenting the supply of air, the point was reached at which an explosive mixture was

formed in the tube, which took fire, and by rapid explosions caused a whistling sound.

Classification of Petroleum Distillations.

By request, Dr. Vanderweyde wrote upon the black-board the following table, in which the hydro-carbons passing off between various degrees of heat are designated, the first named being a gas at ordinary temperature, which he has compressed to a liquid for the purpose of producing cold, by its evaporation or expansion, and has been distinguished by the term Chimogene. The first contains the *highest* temperature up to which body escapes; the second its name; the third, its gravity, according to Baumé's hydrometer; the fourth, its specific gravity; and the last, the limits of its boiling points on the Fahrenheit scale.

Scale.				B. P.
At 70°	we have Chimogene	gr. 95 to 100	Sp. gr. 0.59 to 0.61	20 to 60
At 120°	we have Rhigolene	gr. 90 to 95	Sp. gr. 0.62 to 0.60	60 to 90
At 170°	we have Gasoline	gr. 80 to 90	Sp. gr. 0.63 to 0.62	90 to 120
At 230°	we have Naphtha	gr. 70 to 80	Sp. gr. 0.67 to 0.63	120 to 150
At 300°	we have Benzine	gr. 60 to 70	Sp. gr. 0.73 to 0.67	150 to 200
At 400°	we have 1: Kerosene	g. 50 to 60	Sp. gr. 0.73 to 0.73	200 to 240
At 500°	we have 2: Kerosene	g. 40 to 50	Sp. gr. 0.82 to 0.78	240 to 280
At 600°	we have 3: heavy K	g. 30 to 40	Sp. gr. 0.86 to 0.82	280 to 300
At 700°	we have	Solid paraffine and illuminating gas.		
At 800°	we have	Solid paraffine and illuminating gas.		

It must be remarked that the three lightest products cannot be separated from the heavier, by one single operation, but require repeated distillations; the same as is the case in separating strong alcohol from fermented liquors. Also that the temperature required to separate or move volatile products from a less volatile is higher than the boiling point of the more volatile product, when once separated; so it is seen in the above table, that it takes 170° to separate gasoline from the petroleum; yet the gasoline itself will boil at from 50° to 60° lower temperature, and so for all the others.

An interesting discussion followed on retaining the common names of these products, and the confusion of meaning now existing in relation to such terms as gasoline, naptha, benzine, benzole, etc. After which, the Association adjourned.

AMERICAN INSTITUTE, POLYTECHNIC ASSOCIATION,
November 8, 1866.

Prof. S. D. Tillman in the Chair; T. D. Stetson, Esq., Secretary.

THE AVERY REACTING STEAM ENGINE.

A very interesting relict of the past, presented to the Institute by Wm. Avery Sweet, Esq., President of the Onondaga steel works, called the Avery steam engine, was exhibited. It consists simply of two flat hollow arms, shaped like oar-blades, which are fastened to a hollow shaft through which steam enters and is discharged near each end, but on opposite sides of the blades. The blades move in an opposite direction to which the steam is discharged. A circular box usually encloses the revolving arms from which a pipe conducts the exhaust steam.

The chairman remarked that the Avery engine was the most improved form known of the oldest engine on record. The Æolipile, said to have been invented by Hero, of Alexandria, was in fact a boiler and engine, for the arms, instead of being fastened to a hollow shaft, were connected with a hollow globe less than half filled with water, and under which a fire was made. The Æolipile should not be dignified with the name of steam engine, for it never could have worked effectively; but while the water in the globe was boiling, it served to show that motion could be obtained by the escaping steam. The Avery engine does not move by virtue of the escaping steam pushing on the atmosphere, as many suppose, for the arms will revolve in a vacuum. It moves by the reacting pressure of the steam which is greatest on that side of the hollow arm opposite to the minute hole through which the steam is discharged. It is quite evident that but fifty per cent. of the full power the escaping steam can be utilized. Even this per cent. can only effectively be applied by arms revolving at very high velocity. In the engine now exhibited, with steam at 100 pounds pressure, the whole power applied would not exceed five pounds at the end of each arm, but as the arms made more than one thousand revolutions per minute, it will be found by calculation that, when geared down to run slow, the driving wheel had great power.

All attempts to make an economical reacting steam engine have proved futile. Yet this engine in some kind of work has been very serviceable; and where fuel was of no value, as for instance in a backwood's saw mill, and high speed was required, without

much gearing, this engine answered a good purpose. It has no valves, and does not require an educated engineer to run it. At present we estimate the value of an engine by the proportionate quantity of fuel consumed; and by this standard all reaction engines will be condemned.

The chairman presented the following scientific items:

New Process for Obtaining Heavy Hydro-carbons.

Mr. James Young, Jr., of Limefield, Great Britain, has patented a process for distilling either crude or partially rectified hydro-carbons under pressure, by which heavy oils originally operated on are converted into oils of lower specific gravity possessing a higher commercial value. The process is carried on in an ordinary steam boiler, without tubes, under a pressure of about twenty pounds to the square inch.

New Mineral from Greenland.

Prof. Shephard, of Amherst College, has recently analyzed a new mineral sent to him by G. Hagemann, chemist to the Natrona Chemical works, Allegany county, Pa. It was found at Arksutfiord, Greenland, in seams or veins, from one third to half an inch in thickness and generally having cryolite (*alam-sodimeaf*) closely adhering to its sides. Its color is ochre or wax-yellow, with a a faint tinge of green. The hardness of several specimens ranged from 3. to 3.5, and their specific gravity from 2.59 to 3.60. The mean percentage of their components are — aluminum, 12.06; iron, 5.96; calcium, 11.18; magnesium, 2.30; sodium, 8.45; fluorine, 40.30; silicon, 7.79; water, 10.44; insoluble portion, 1.08. The mineral contains a trace of phosphoric acid. Its most remarkable feature is the number of metals found in connection with fluorine.

Minerals from South Hampton Lead Mine.

Prof. Shephard has also lately described two minerals as rare products of this mine. The first is scheelite, or tungstate of lime, and the second cotunite, or chloride of lead, consisting of crystals bearing the form of right rectangular prisms, without transparency, and perfectly milk white.

An Improved Method of Producing Oxygen.

Messrs. Maréchal and Fessié du Montay, of Mentz, France, have patented a new process for separating oxygen. They state that

manganates and permanganates of potassa, soda, and baryta, ferrates of potassa, soda and baryta, chromates of potassa, soda and baryta, and generally all metallic oxides or acids which will form with potassa, soda or baryta binary compounds capable of superoxydising, possess the property of yielding their oxygen, at a more or less elevated heat, when they are submitted to the action of steam. Such bodies when deoxydized will become reoxydized when exposed to a current of heated air. The apparatus of the patentees consists of a retort in which by the application of a current of air to any of the compounds before mentioned they are brought to the maximum state of oxydation. They are then deoxydized by a current of steam or by injecting water; the oxygen and steam pass from the retort into a condenser where the steam is condensed to water and the oxygen is collected in a gas-holder. When the compounds in the retort have given off a portion of their oxygen they are again subjected to the action of air, and afterwards to steam or water, and thus by this continued alternation the same materials continue to supply oxygen as long as required.

The process is said to work with great regularity, and will doubtless be of great value in metallurgical operations. Oxygen had been obtained previously from permanganates by the action of heat, and these were afterwards subjected to air and reoxydized, but the patentees, by the use of steam as a heater, have succeeded in deoxydizing a large class of compounds which may be reoxydized by common air.

Tetra Chloride of Carbon or Arod.

Mr. Charles Crump, of Yealpton, England, has patented a process for preparing $C\,Cl_4$ or *Arod*. He dissolves a small quantity of iodine or of bromine with bisulphide of carbon, (*ares*). Dry chlorine gas is then passed into this solution as long as it is absorbed, or until crystals of chloride of iodine (*avad*) begin to appear. The compound thus formed is a mixture of tetrachloride of carbon (*arod*) and sub chloride of sulphur (*asad*); it is digested with sulphur by which *asad* is converted into *asod*. Afterwards *arod* is partially separated by distillation and treated with a solution of lime or potash, or similar material, for its purification.

New Test for Iodine.

M. Carey Lea, of Philadelphia, has published in Silliman's Journal a new method of detecting very minute quantities of iodine.

It occurred to him that the facility with which that body is eliminated from its hydrogen and metallic compounds by chromic acid (*el-chromot*) would make the latter substance a valuable means of bringing about the starch reaction. Experiments completely confirmed this view. For example, a solution of iodide of potassium (*potamad*), so dilute that the addition of nitric acid or starch produces no perceptible effect by the further addition of a single drop of dilute solution of bichromate of potash (*potem-chremeit*) will instantly bring about reaction. Such reaction is still more marked when hydrochloric acid (*thalad*) was substituted for nitric acid (*thalanit*). Solutions containing one 400,000th of potamed gives the iodine reaction at ordinary temperature.

Cold Bleaching Process.

M. Tessié du Mothay and M. Rousseau describe very satisfactory trials which they have made of a cold bleaching process, by which all textile materials (whether silk, cotton, linen, flax, wool or any woolly fibre) can be bleached. The agent employed is permanganate of soda, slightly acid, prepared by a new and economical process. With this salt, the extraordinary properties of which have of late years been much studied, a bath is prepared, in which the materials to be bleached are dipped. They are stirred about with a glass rod from time to time, and after about ten minutes they are taken out of the bath, strongly colored of a violet brown hue by an abundant deposit of oxide of manganese. They are then dipped as quickly as possible in a bath of water, acidulated with sulphurous acid, and again stirred and turned over with a glass rod, and after two or three minutes the materials or thread, originally of a yellow or gray color, are already white. These operations are repeated twice more, and the result is a brilliant white, while the fibres are in no way injured. The materials operated upon were cotton fabrics, dirty, as they came direct from the loom, as well as skeins of linen thread, of a dark slate color, which, by existing processes, would have taken many days to bleach.

Chloride of Zinc as a Disinfectant.

As the season of vile odors and foul miasms is opening upon us, with a dark cloud of cholora glooming in the horizon, the question of disinfectants assumes more than ordinary interest. We notice in the daily papers a circular from Dr. S. C. Blake, the city ph sician, recommending the use of chloride of zinc for the purifica-

tion of basements, vaults and sick rooms. In this he agrees with the distinguished chemist, Prof. Blaney, of Rush Medical College, who, in a recent letter to Mr. E. H. Sargent, the manufacturer, writes as follows: "There is abundant scientific authority—with which my own experience accords—to prove beyond doubt the immense value of this agent as a deodorizer, and, in a high degree, as a disinfectant. While it is equally as prompt and efficient as chloride of lime, the best known and the longest used of the deodorizers, it has over it the great advantage that it has no offensive odor of its own when neutral, and may be freely used about the persons and clothing of the most sensitive persons without exciting any feeling of disgust. As a deodorizer, for use in closed apartments, and within dwellings for general family use, I am of the opinion that the chloride of zinc is the most safe, the most prompt and the most efficient of the deodorizers now furnished for general distribution."

Potent Disinfectant.

The *Dublin Medical Press* states that Dr. Dewar, of Kirkcaldy, has discovered that "for the disinfection of inanimate material the addition of a little nitre to sulphur, and the combination of these fumes with the steam of boiling water, improvises a disinfectant at once the most powerful, most searching and most efficacious which can be obtained, utterly destructive at once of any latent contagion, and of every form of insect life."

Collodion.

By John P. Maynard, M. D.—Take two parts of sulph. acid, sp. gr. 1.850, and one part nitric acid, sp. gr. 1.450. Mix them—allow the temperature to fall to about 100 deg. Fahrenheit. Add to this raw cotton, to point of saturation. Let it soak about one to two hours. Pour off the acids. Wash the cotton till litmus paper shows all acidity removed. Dry thoroughly. The cotton will now be found to be converted into a gum, completely soluble in ether, of about .750 sp. gr., or in pure ether three parts and alcohol ninety-five per cent. one part. About two ounces of cotton thus prepared will make about one pint of collodion of proper consistency for surgical purposes. For photographic objects, a less amount will be sufficient. The conditions for success for this formula are simply precision in the details and careful manipulation, which a little experience will perfect.

How to Test the Presence of Lead in Water.

A very ready test for lead in water consists in taking two tumblers, and filling one with water which is known not to have been in contact with lead; the other being filled with the suspected water. Dissolve in each about as much bichromate of potash as will stand on a dime. By daylight the water in each tumbler will be of the color of pale sherry and water. Cover the tumblers so as to keep out dust, and let them stand in a warm place in a room with a fire in it for twenty-four hours. If the suspected water be free from lead, it will have the same color as the other; but if there be lead in the water, it will have a more or less opalescent tint, as if a drop or more of milk had been put into it. If there be a great quantity of lead in the water, a very slight film of lead will be deposited on the glass.

Glue.

Powdered chalk added to common glue strengthens it. A glue which will resist the action of water is made by boiling one pound of glue in two quarts of skimmed milk.

Prepared Liquid Glue.

Take of best white glue sixteen ounces; white lead, dry, four ounces; rain water, two pints; alcohol, four ounces. With constant stirring, dissolve the glue and lead in the water by means of a water bath. Add the alcohol, and continue the heat for a few minutes. Lastly, pour into bottles while it is still hot.

Marine Glue.

Dissolve three parts of India rubber in thirty-four parts of coal tar naptha—aiding the solution with heat and agitation; add to it sixty-four parts of powdered shellac, which must be heated in the mixture till the whole is dissolved. While the mixture is hot it is poured upon metal plates in sheets like leather. When required for use, it is heated in a pot till soft, and then applied with a brush to the surfaces to be joined. Two pieces of glue joined with this wood can scarcely be sundered.

News for Tobacco Smokers.

The Count De la Tour Dupin has given a valuable hint to tobacco smokers. It is a current opinion that the most expensive tobaccos contain the least nicotine; and the Count gives us a plan by which a man may smoke *caporal* and only get the effects of the

best Havana. It is very simple. Only place somewhere between the pipe-bowl and your mouth, so that it may be traversed by the smoke, a pledget of cotton wool soaked in a solution of tannic or citric acid, and that will arrest the greater part of the nicotine. According to the experiments of the Count, the proportion of the nicotine in the original smoke to that in the smoke after it has passed through the cotton is as seven to two.

A piece of newspaper or blotting paper placed in the bottom of the pipe before filling it with tobacco, answers the same purpose.

Weak Eyes.

Weak eyes may be strengthened by washing them night and morning in a solution of acetate of zinc and rose water, in the proportion of two grains of the former to two ounces of the latter.

Colds in the Head.

The inhalation of the tincture of iodine, by holding a vial of the tincture under the nose, repeated every three minutes, will soon conquer this annoying malady.

Adulteration of Opium.

Landerer states that opium is adulterated in Asia Minor (Turkey opium) with crushed raisins and jalep. The former is detected by ascertaining the presence of grape sugar with Barreswill's or other cupro-potassic solution ; the latter will be recognized by tincture of iodine showing the reaction of starch.

Novel Experiments.

Dr. Vander Weyde continued his remarks on the subject of the combustion of gas, made at the former meeting. He exhibited a colossal burner made of a wide glass tube four feet long, at the top of which a mixture of gas and air burned with a flame, which changed in color and luminosity in proportion that the relative quantities of gas and air were changed. Pure gas produced a large yellow luminous flame; the admixture of a little air to the gas, caused the flame to become smaller, paler, less luminous, but evolving more heat, proving what great disadvantage there is in burning gas if used solely for illuminating purposes, when it is mixed with the smallest quantities of air; increasing the air makes the flame still more blue, till finally it burns with a flame producing scarcely any light but the maximum of heat. This last point gave occasion to a discussion, several members present

doubting if not the same quantity of gas would always produce the same amount of heat in whatever way it was burned, and the Dr. promised to make calorimetric experiments to prove his theory that the amount of light evolved is at the expense of heat, and vice versa, so that we cannot have the maximum of both, when burning gas. He further showed how, when continually increasing the relative quantity of air in the burning mixture, till it amounted to about twenty times that of the gas, an explosive mixture was formed in the tube, which not only would burn at the top where it is in contact with the air, but would take fire in the interior of the tube, the flame suddenly passing down in the tube with an explosive whistling noise; he showed how this noise was the strongest at a certain part of the tube, and by placing at that point a wire gauze he prevented the flame from going down any further, and succeeded in continuing this whistling noise, quite similar to a steam-whistle. He stated to have applied this arrangement to a burglar alarm, attaching it to a night lamp; the opening of a door or lock turning the gas on and producing the noise; also attaching it to a clock, the alarm was produced at any desired hour. The Dr. by using different sized tubes constructed a kind of organ, which however he found impossible to have in tune, by reason of the continually changing temperature of the pipes and air columns they contained.

Dr. J. B. Rich stated that the reason why insurance companies will not insure petroleum is owing to experiments made by this branch of the American Institute, in which it was shown that if petroleum is confined in a close room, it will give off a vapor that at times will become liable to explosion. There is no petroleum but will give off a gas that is explosive. We made these experiments so carefully that there is no doubt about them.

Mr. L. B. Page said he had 150 varieties of petroleum; some of these came from a depth of 750 feet, which he found always to be very light. He had some of sixty specific gravity that came direct from the well. He had also an oil of sixteen specific gravity, Baume's scale, from California.

Dr. Rowell enquired if it was not possible that earthquakes may take place from the admission of air to these deep wells of oil.

Mr. Joseph Hirsh performed some experiments with petroleum. Here, he said, was some petroleum just as it came from the still this morning; the bottle is about half full, and here is sulphuric

acid which is also white. Now by pouring this acid on the oil which is transparent, and shaking it a little, it will become red. and if shaken more and a little acid added to it, it will turn black, There is now a small portion of the bottom jet black. The oil has lost part of its carbon and that carbon has been deposited at the bottom. The oil contains hydrogen and carbon. Part of the hydrogen will unite with part of the oxygen and form water. The way to remove the color of the oil after treating it with acid is to add water, which turns it a milk white. Oils can be oxydized by other methods than burning them. Alcohol can be made from this oil as good as any alcohol made from grain. Common gas contains four equivalents of hydrogen and four carbon. Alcohol is four of carbon, six of hydrogen, and two oxygen.

Adjourned.

American Institute Polytechnic Association,
November 15, 1867.

Prof. S. D. Tillman in the chair; T. D. Stetson, Esq. Secretary.

Good Wells made in One Hour in most Localities.

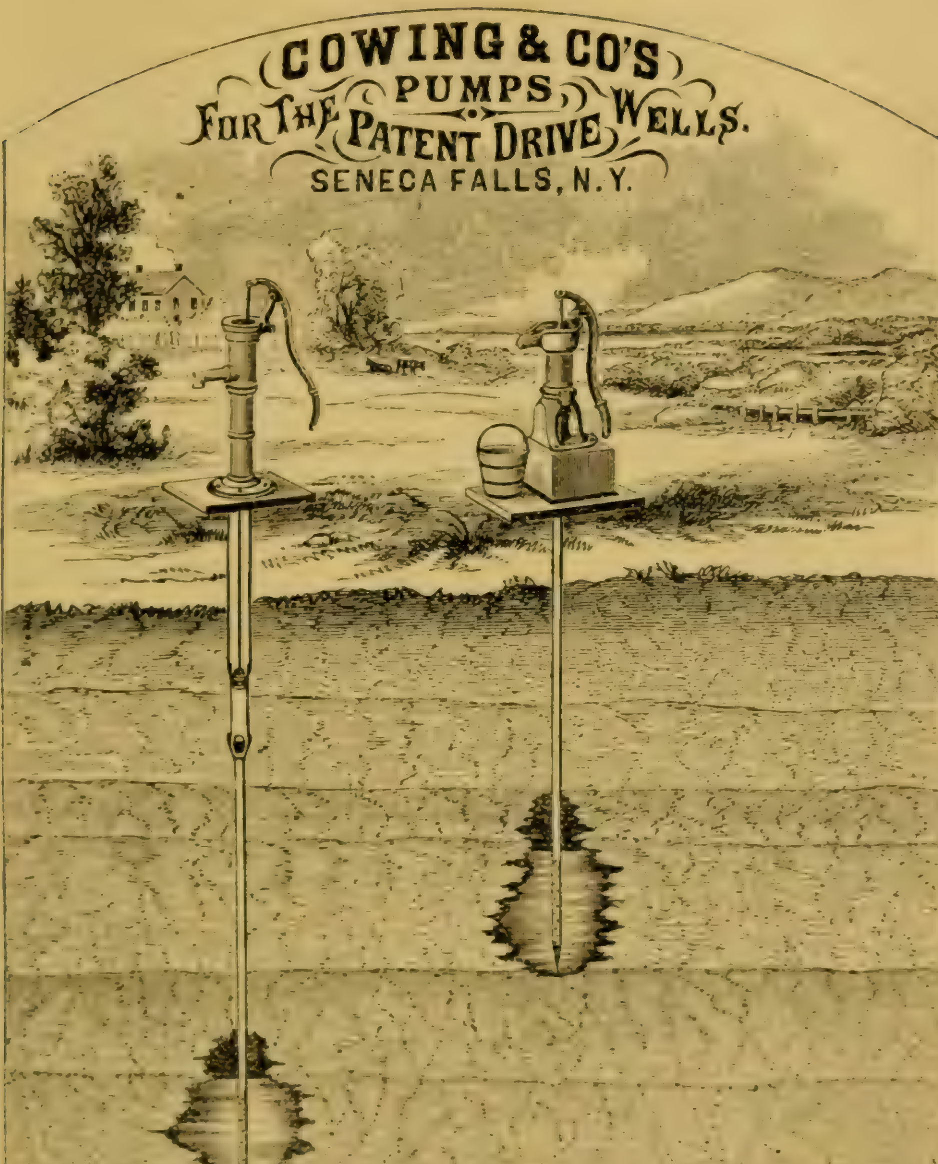
The Chairman read a description of the method of making wells very quickly, as practised by Cowing & Co., of Seneca Falls, N. Y.

These wells are made by driving into the earth common iron gas pipe (suitably pointed and perforated) to the required depth (usually sixteen to thirty feet), attaching one of Cowing & Co.'s pumps, as represented by accompanying illustrations, and after pumping a short time the fine particles of sand and gravel will be drawn to the surface, causing a cavity below, which is kept filled with pure water by the vacuum created with the pump. There are several different modes of pointing and driving the pipe, for which patents have been issued. That firm are prepared to fill orders for dealers, and also to those who are engaged in putting down these wells, and would call attention to their anti-freezing pumps, made with especial reference to this business.

New Fire Boxes for Boilers.

Mr. Joseph A. Miller, of New York, exhibited drawings of his improvements on boilers for steam engines, and explained their construction as follows:

It is a well known fact that the steam producing capacity of all boilers depends upon the amount of surface exposed to the action


COWING & CO'S
PUMPS
FOR THE PATENT DRIVE WELLS.
SENECA FALLS, N.Y.

of the fire; to increase, therefore, this surface, is the aim and object of most improvements in steam boilers. There is, however, another fact not so universally known, which, however, is daily more acknowledged, viz: That one square foot of heating surface at, over and around the fire is worth more than ten square feet twenty or thirty feet from the fire. The constantly increased dimensions of the locomotive fire box is the best practical illustration. It is also well understood that the thinner the sheet of water exposed to the action of the heat the more rapid will be the production of steam. The object of this invention is, therefore, to construct a fire box presenting the largest possible amount of surface to the direct action of the fire, and keeping in contact with it only a thin film of water, in such a manner that no matter how rapid the evaporation may be, the same thickness of water be always in contact with the surface exposed to the fire. These steam fire boxes add fully one hundred square feet of heating surface to any steam boiler. When we now find that a forty-eight inch diameter boiler, with two flues, eighteen inches diameter, each thirty-six feet long, contains three hundred and ninety-six square feet of heating surface, and remember the fact that the surface of the first ten feet over the fire, containing eighty square feet, is the most valuable portion of the whole boiler, it must be apparent to any practical mind that the addition of one hundred square feet of surface on each side of the fire, and in immediate contact with the same, will double the steam capacity of the boiler, to say nothing of the important fact that the sheet of water exposed to the fire in these boxes is *one inch* in thickness, whereas the body of water in the boiler, exposed to the action of the fire, has an average thickness of twenty-four inches.

The principle feature of the improvement consists in a series of vertical tubes or cells, arranged upon each side of the boiler, and forming the side walls of the furnace. Fig. 1 represents it as applied to the common cylindrical boiler; the brick work being removed so as to show the plan more fully. The series of vertical pipes A are arranged upon each side of the boiler, in close proximity, and have open communication with each other at their upper and lower ends. This series of pipes are fastened to each other by bolts passing through the flanges at the transverse openings at the ends, and are also more securely fastened by iron rods that pass horizontally through the upper and lower chambers—the ends of these rods passing through the covers or caps of the cham-

bers, and serving the double purpose of holding the caps to their places, and the series of pipes in their order.

The interior of these pipes or cells, Fig. 2, A, are divided vertically by a diaphragm, so as to form an inner cell, as seen in sections at B, and are so constructed that while the lower part is below the fire-grate, the upper part is above the water level. As will be seen by the view in section, they are so divided that a thin film of water is presented to the action of the fire, and is almost immediately converted into dry steam, and passing into the pipe D, Fig. 1, is there mingled with the saturated steam of the boiler. As the film of water nearest to the fire is evaporated, it is fed or supplied with water from the other divisions of the tube formed by the diaphragm. These divisions are kept supplied with the requisite amount of water by the pipe E. The cylindrical boiler is also supplied through the extension, C, of the same pipe. By means of globe valves, conveniently placed, the feed water can be shut off from the boiler or from the vertical pipe, as may be desired.

One section consists of nine pipes, each eight inches in diameter. When set between two boilers they form the partition walls, and no heat is lost by burning out fire brick, no clinkers are formed, nor need they ever be replaced, as the fire has no influence on them, water being always in contact with the metal. These sections are substantial, safe and durable; my aim being to present to owners of steam boilers an improvement not liable to repairs, and consequent stoppages, knowing that an improvement which, under all circumstances, will refund its cost, by saving of fuel, in six months, will be of financial value to them. One section or partition weighs, on an average, 4,500 pounds, and every section is subjected to a pressure of 200 pounds to the square inch before leaving the works.

For steamboats on the western rivers these steam fire boxes are of great value, first, in doubling their steam capacity, and second, as the bottom of the boxes are below the grate, and thirty inches below the bottom of the boiler, all sediments which would form incrustations over the most valuable heating surface is drawn into the boxes, from whence it is blown, as often as required, by opening the blow-off valve E. Each one of the pipes in the steam fire boxes is a *complete steam boiler*, containing its thin film of water near the fire ascending, its larger water reservoir not exposed to the fire descending, and sufficient steam room to make perfectly dry steam.

Miller's Fire Box Boiler.

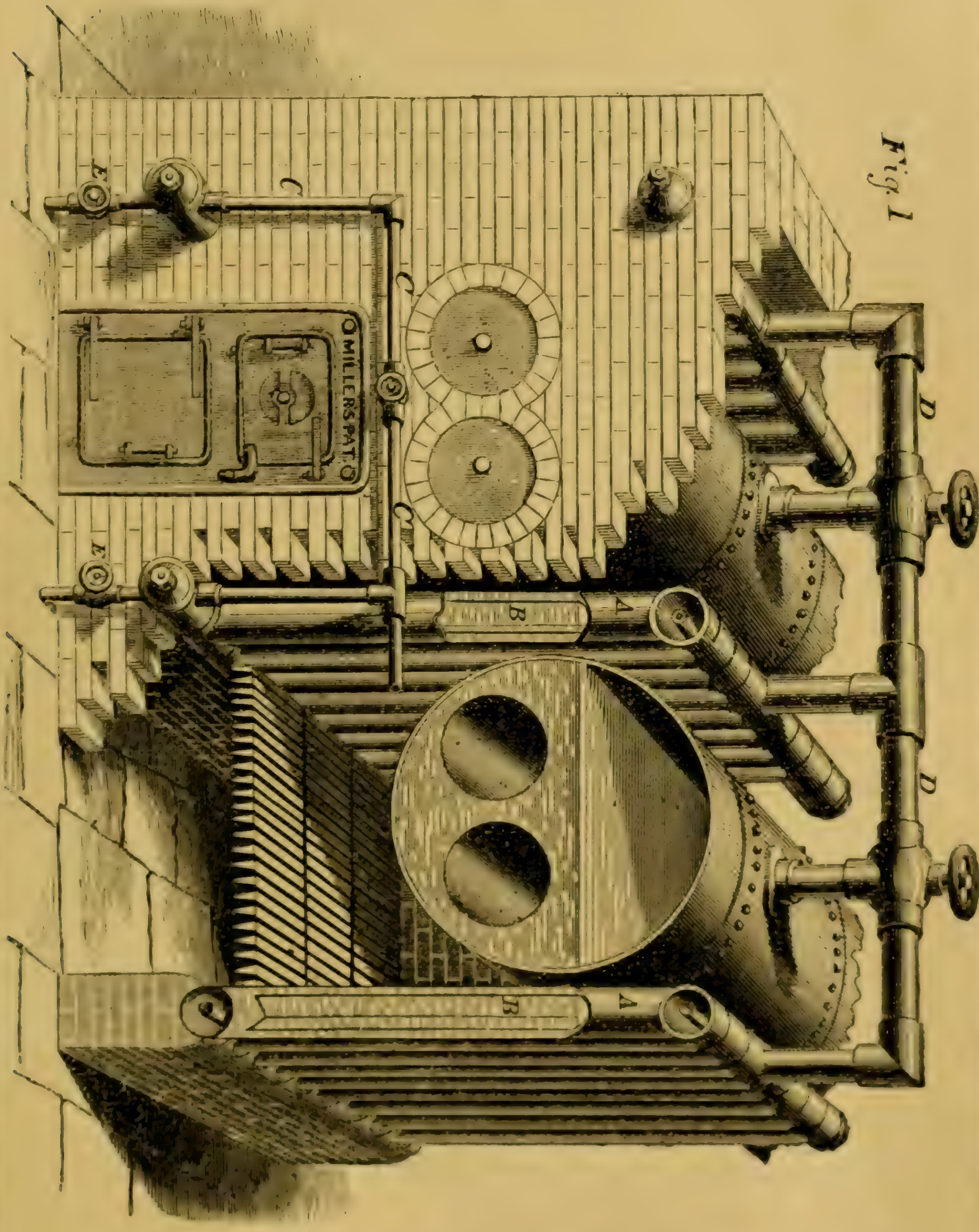
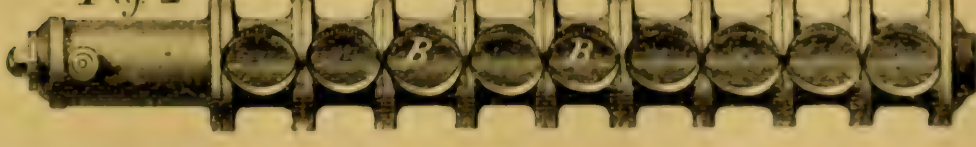


Fig. 1

Fig. 2



These steam fire boxes will make one hundred pounds of steam when attached to either cylinder flue or tubular boiler, before the water in the boiler reaches the boiling point, when starting with cold water and a bright fire.

They can be attached to all kinds of boilers. Are in constant use in some of the largest establishments in Rhode Island, New York, &c., where they are attached to cylinder flue, hog-nose and tubular boilers with equal success.

After some discussion of the advantages of Mr. Miller's improvement, the following paper was read :

Chemical Compositions of Petroleum.

P. H. Vander Weyde, M. D., of Philadelphia : I have at last succeeded in establishing beyond a doubt the formulæ for the chemical composition of petroleum. As far as I am aware, all that has been known about it, up to the present time, is the result of the practical experience of distillers, who obtained liquid hydro carbons of different degrees of volatility and specific gravity, a portion escaping as gas, and in the remaining tar (containing the non-volatile constituents), was also found a large amount of free carbon in suspension, the product of destructive distillation : for, as a high temperature has the tendency to distill from any hydrocarbon a compound richer in hydrogen, the remnant of the distillation will be richer in carbon, and at last be nothing but carbon itself.

It is also known that the different products of the distillation are very soluble in one another, so much so, that during this process it is impossible to tell where one ends and the other begins; in fact it requires repeated distillation to separate them, exactly in the same way as it requires repeated distillation to separate alcohol from water, which two substances are also very soluble in one another.

Further, it is known that the products of the distillation of petroleums obtained from different localities do not differ in their nature, as is the case with the crude petroleums themselves, but are in general a uniform article, differing only in the quantities obtained, in their perfect separation from one another, and in some small amounts of flavoring ingredients, of which I will speak hereafter. As regards the crude oil, when it is very light, exceedingly volatile products are obtained in great quantity, to the loss of the manufacturer of burning oil, who therefore prefers a crude petro-

leum of a mean specified gravity of about 43° Baumé. When the crude petroleum is too heavy, the gaseous and very volatile products may be entirely absent, even to such a degree as to cause a loss for the opposite reason, leaving too large a quantity of tar, the result of an excess of non-volatile matter. Such oils are therefore used as lubricators. Besides this variety in crude petroleum, the petroleums of different wells (of which the fundamental formula is, as I will below explain, $C_n H_n + {}_1, H$) differ as much in the incidental substances they contain in solution or suspension as the water (of which the fundamental formula is H_o) of different springs.

In the same manner as waters differ in containing salts of lime, soda, potassa, etc., or chlorides, bromides, iodides, sulphates, etc., so crude petroleums differ in containing oxygen or sulphur, nitrogen or phosphorus, arsenic, iron, etc. These incidental constituents, some of which are left behind, in the remnant of the distillation (the tar), have nothing to do with the chemical composition of the pure petroleum, the same as pure distilled water is independent of the incidental salts it contained before the distillation. Analyzing the tar or coke left from different kinds of petroleum demonstrates the presence of quite a variety of ingredients, which, however, will teach us as little about the nature of pure petroleum, as the analysis of the salts of mineral waters will teach us about the nature of the chemical composition of water; and even as eudiometric experiments are the most striking proof that pure water is H O, so eudiometric experiments prove that pure petroleum is C H, though with certain variable coefficients, which I will explain.

I intend later to publish a separate paper containing all the details of my quantative analysis, which would take up too much time, and besides be dry and uninteresting to most hearers. I will in the first place only state, that (as might be anticipated) the amount of hydrogen is largest in the first gaseous products of the distillation, less in the lighter fluids, as gasoline, naptha, benzine, still less in kerosene, and least of all in paraffine. These substances are all constant in their atomic constitution, although they are apt to contain variable quantities of the volatile constituents of crude petroleum (as oxygen, sulphuretted, phosphoretted or arseniuretted hydrogen, etc.), always comparatively very small, but enough to give the distillates their strong characteristic odor. They are easily removed by concentrated sulphuric acid, which

also removes the oxygen often present in petroleum (as it is in water). Sulphuric acid, by its strong affinity to water, compelling all the oxygen in the petroleum to combine with part of its hydrogen, by which action water is formed and some carbon is separated; in fact this acid decomposes part of the hydro-carbons, as destructive distillation does, by robbing some carbon of its hydrogen, setting it free and coloring the oil black.

In regard to the relative quantities of carbon and hydrogen, I found the lightest kinds of the so-called gasoline of 96° specific gravity, to contain eighty-three per cent of carbon to seventeen per cent of hydrogen.

The liquid I discovered last year and called chymogene (cold generator), obtained by condensing by pressure and cold the gases escaping in vacuo, at the common temperature, consists of eighty-two per cent of carbon and eighteen per cent of hydrogen. The gases collected from the top of barrels coming fresh from the wells, are found to contain eighty to eighty-one of carbon and twenty to nineteen of hydrogen. Benzine contains about eighty-three and a half carbon to sixteen and a half hydrogen. Kerosene about eighty-four carbon to sixteen hydrogen; and paraffine, found long ago by others, a little over eighty-five carbon to a little less than fifteen hydrogen. Let us recapitulate these, and add the two extremes of the series, marsh gas $C_2\ H_4$ and olefiant gas $C_4\ H_4$.

			Carbon.	Hydrogen.
Marsh gas contains in 100 parts			75	25
Vapor from top of barrels,		do	30	20
Vapor from top of barrels,		do	81	19
Chymogene gas contains		do	82	18
Rhigolene	do	do	83	17
Gasoline	do	do	83	16.5
Benzine	do	do	84	16
Kerosene	do	do	84.7	15.3
Kerosene	do	do	84.5	15.5
Paraffine	do	do	85	15
Olefiant	do	do	86	14

It is further found that the pure gasoline possesses all the properties of the so called hydride of butyle, of which the formula is $C_8\ H_{10}$, and thus consists of forty-eight of carbon to ten of hydrogen, very near the relative quantities found above; that the gases taken from the empty spaces in the barrels are very much like the so-called hydride of ethyle and propyle, as well in their chem-

ical composition as physical properties, and we are forced to the conclusion that the different volatile constituents of pure petroleum are nothing but the members of the well known series of the homolognes of marsh gas, of which the general formula is $C_n H_n + {}_2$ or rather $C_n H_n + {}_1$, H, in which n may represent any number, as will be clear from the following table, to which are added the new names, according to Prof. Tillman's system, in which the atomic weight of carbon is 12, and is represented by either *c* or *r*. One atom of hydrogen is denoted by *al*, and two atoms by either *el* or *ah;* thus $C_2 H_2$ according to the old notation is expressed by *ach*, and all its multiples a different vowel prefix.

Table of the formulæ; chemical names and corresponding old and new names of the volatile main principles of petroleum.

Formula.	Chemical names.	Common names.	New names.	Specific gravity. Water = 1.	Specific gravity. Beaum. Hydrom.	Boiling point, Degs. Fahr.
$C_0 H_1$ H	Hydrogen	Hydrogen gas				
$C_2 H_3$, H	Hydrid of methyle	Marsh gas	*Achel*			
$C_4 H_5$, H	do ethyle	Petroleum gas	*Echel*	0.605	98 degrees	
$C_6 H_7$, H	do propyle	Chymogene	*Ichel*	0.62	94 do	30 degrees
$C_8 H_9$, H	do butyle	Rhigolene	*Ochel*	.64	88 do	60 do
$C_{10} H_{11}$, H	do amyle	Gasoline	*Uchel*	.670	80 do	86 do
$C_{12} H_{13}$, H	do caproyle	Naptha	*Eachel*	.705	70 do	150 do
$C_{14} H_{15}$, H	do heptyle	Benzine	*Eechel*	.745	60 do	195 do
$C_{16} H_{17}$, H	do octyle	Kerosene	*Eichel*	.785	50 do	240 do
$C_{18} H_{19}$, H	do nonyle	Kerosene	*Eochel*	.830	40 do	264 do
$C_{20} H_{21}$, H	do decatyle	Heavy kerosene	*Euchel*	.854	35 do	320 do
$C_{22} H_{23}$, H	do endecatyle	Lubricating kerosene,	*Yachel*	.880	30 do	356 do
$C_{24} H_{25}$, H	do dodecatyle	do do	*Yechel*	.885	29 do	380 do
$C_{26} H_{27}$, H	do cocinyle	do do	*Yichel*	.888		420 do
$C_{28} H_{29}$, H	do miristyle		*Yochel*	.890	28 degrees	460 do
$C_{30} H_{31}$, H	do benyle		*Yuchel*	.893	27 do	490 do
$C_{32} H_{33}$, H	do cetyle	Paraffine oil	*Yeachel*	.897	26 do	520 do
$C_{34} H_{35}$, H	do margaryle		*Yeechel*	.900	25 do	550 do
$C_{36} H_{37}$, H	do stearyle		*Yeichel*	.90	25 do	560 do
$C_{38} H_{39}$, H	do balenyle		*Yeochel*			
$C_{40} H_{41}$, H		Solid paraffine	*Yeuchel*	.880		
$C_{54} H_{55}$, H	Hydrid of ceryle	do	*Weechel*			
$C_{60} H_{61}$, H	do melissyle	do	*Weuchel*			
$C_x H_x$ or $C_4 H_4$		Olefiant gas	*Gerlel*	?	?	—150 degs.

The temperature at which their different volatile products are imperfectly separated from the crude petroleum, is much higher than the boiling points given above, and must not be confounded with them. Three temperatures of distillation I have given approximately at a former meeting.

This table contains all the different combinations of carbon and hydrogen, commencing with pure hydrogen, then taking the equivalent of carbon equal to half the hydrogen and increasing both until an equal number of atoms is reached in the olefiant gas, which comes off at the end of the distillation, when also the paraffine is formed; the differences between the number of atoms of both elements become therefore relatively smaller; when the coefficients become for instance 1,000, we would have $C_{1,000}$ $H_{1,001}$, and finally they must become alike to all practical purposes; when we develop olefiant gas, and have coke left, in case we continue the distillation to its extremity. Olefiant gas is in the relative quantities of its chemical contents much more like the paraffine than like the condensable gaseous products coming over at the beginning of the distillation; it is also known that olifiant gas requires very powerful pressure to be liquified, surpassing even that required for carbonic acid and nitrous oxid.

We may extend our series in the opposite direction, namely, making the atoms of hydrogen less than those of carbon, and diminish them till we have reached the pure carbons; the first number of this series is woody fibre, of which the formula is C_{12} H_{10} O_{10}, which we will divide by two for the sake of exhibiting the remarkable progression of the series, in which I have made up the formula after the quantitative analysis of the most reliable authorities.

Table of the formulæ and corresponding names of the products of the carbonization of wood.

Formula.	Name.
C_6 H_5 O_5	Fresh dry woody fibre.
C_8 H_6 O_4	Decaying wood.
C_{10} H_6 O_3	Turf or peat.
C_{12} H_6 O_2	Lignite.
C_{14} H_6 O	Cannel coal.
C_{16} H_6 O	Cherry coal.
C_{18} H_6	Cake coal.
C_{20} H_6	German blacksmith's coal.
C_{22} H_6	Anthracite coal.
C_{100} H	Lampblack.
C_{400} H	Charcoal.
C_8 H_0	Pure coal or carbon.

The formulæ for lampblack and charcoal are founded on the latest investigations about those substances, proving that they contain some very small amount of hydrogen very intimately combined.

The apparent increase in the amount of carbon in this series is simply caused by the entire loss of oxygen and partial loss of hydrogen, taking place during the progress of the chemical changes through which vegetable fibre passes, when in the process of combination.

The following extracts were presented by the Chairman:

The Fire-Extinguishing Cartridge.

The latest invention in France is a sort of cartridge, containing ingredients which are capable of extinguishing fire. This is effected by the sudden development of a large quantity of hydrochloric acid gas. The scientific principle has long been known, but it has never been put into a practical form. The cartridges resemble brown paper parcels, and are of two sizes. No. 1 is about eight inches long and two and a half inches wide, and is intended to be thrown by the hand into the heart of the fire. A string is also attached by which it may be projected as from a sling. The cartridge is slightly explosive, so as to scatter the substance producing the extinguishing gas. No. 2, or the second sized cartridges, are simply thrown (the cover being torn off) into the water of the engines, which they saturate with a substance producing hydrochloric acid gas as soon as the water touches the fire. Experiments have proved that one-tenth of the water that would have been necessary to extinguish a fire is only requisite when the cartridges are mixed with it, and that the saving of time is in the same ratio. They are very inexpensive.

Curious Experiment.

Procure a basin of milk-warm water, throw into it half-a-dozen pieces of camphor about the size of a pea; they will soon begin to move, and acquire a rotary and progressive motion, which will continue for a considerable time. If now, one drop of oil of turpentine, or sweet oil, or even of gin (if allowed on the premises), be let fall upon the water, the pieces of camphor will dart away, and be deprived of their motion and vivacity. Little pieces of cork, that have been soaked in ether, act much in the same way as camphor, when thrown upon water. Camphor, being highly combustible, will burn if ignited while floating upon water, pro-

ducing a singular effect, reminding one of the lamps which the Hindoo maidens cast upon the waters of the Ganges as mystic messengers to their distant lovers, or to their spirits after death.

Razors.

Engineers, as a class, were the first to head the modern "beard movement" in this country; but many may like to read the following extract from a little work by Mr. Kingsbury, a practical razor-maker, of Bond street: "The edge of a razor, a pen-knife, and every other very keen instrument, consists of a great number of minute points, commonly called teeth, which if the instrument is in itself good condition, follow each other through its whole extent with great order and closeness, and constitute, by their unbroken regularity, its excessive keenness. The edge of such an instrument acts on the beard, the skin or anything else, not so much by the direct application of weight or force as being drawn, even slightly along it; because by this operation, the fine teeth of which it consists pass in quick succession, in the same direction, and over the same part of the substance. My readers wil be convinced of this if they will make the following experiment on their glove or their hand, as they like best: Let them hold the razor either perpendicular or obliquely, and press on it with some considerable force in a direct line from right to left, and they will have no great reason to fear the consequences. But let them move it from that direction, let them draw it towards them, or push it from them, in the smallest degree, in the gentlest manner, and it will instantly make an incision. When they have made this experiment, they will be convinced of the truth of what I have asserted, namely, that in the operetion of shaving, very little weight and even very little force are necessary." Hence it follows that the best razor will have the teeth of its edge set almost as regularly as a good saw, and that the best test in buying a razor is to examine the edge by means of a strong magnifying glass. This also explains the good effect on the keenness of a razor caused by dipping it in hot water, which necessarily clears the edges of any small clogging substances.—*London Engineer.*

"Slag" as a Substitute for Emery.

Among the most useful applications of waste substances to the advancement of industrial art, we think may prove an invention recently patented in England. It is the utilization of the immense

hils of *slag* which surround old established iron-works. It is said that this refuse material may be substituted for emery, and that it is even superior to emery for polishing steel, iron, copper and other metals. The new substance is called "metalline," and can be produced at seventy or eighty per cent less cost than emery.—*The American Journal of Mining.*

A Kerosene Telegraph.

An apparatus termed a "kerosene telegraph" has been invented in Boston. It consists of two small boxes, arranged with levers for opening and closing apertures of an inch and a half in diameter. An ordinary kerosene lamp was placed in each box with a reflector behind it. One of these machines was taken by Mr. Cyrus A. George (also connected with the office), to a point in East Cambridge, a mile and a half distant from the city hall, and at eight and a half o'clock (the time previously agreed upon), his signals were received by his brother, who was stationed in the fire-alarm office in the cupola of the city hall. He answered them, and they continued to converse with great ease and rapidity for an hour, sending and receiving messages. They found no difficulty in reading as accurately and nearly as fast as by the ordinary means of telegraphing. With this apparatus the inventor believes he could operate easily five miles in clear weather, and by increasing the power of the light, ten or fifteen miles. An experiment will soon be made from the Boston office with some distant point in Roxbury or Dorchester.

Meteorology.

The *Moniteur* has published a few remarks by M. Houzeau, well known for his studies on ozone, concerning the anomalous weather in France during the whole of this summer. He says:

Ozone, the principle to which the atmosphere owes the chemical activity it manifests on iodized test-paper made with vinous litmus and starch, exists normally in the country air of our temperate climates. Several causes favor the manifestation of the active properties of air; these are chiefly the winds and aqueous vapor, although, in reality, neither of them, taken separately, acts directly on the test-paper so as to change it to blue. When, notwithstanding the violence of the wind, iodide of potassium is not very perceptibly affected, it may be inferred that the atmosphere does not contain a sufficient dose of moisture to allow of the devel-

opment of chemical reaction. This phenomenon is not rare in chemistry. But when, notwithstanding wind and moisture in sufficient abundance, the idodized test-paper does not turn blue, the active agent ozone is then neutralized by another principle, of an acid nature, contained in the air. This principle, the author tells us, he is now endeavoring to extract from air in the laboratory of the School of Science of Rouen. The air of towns is far from being so rich in ozone as that of the country, its free circulation being impeded by edifices and houses. In the country, on the contrary, the air is free, and that is the reason why it generally produces such good effects on the health of individuals. Storms and hurricanes act chemically on the atmosphere, and their influence in this respect often extends to distances where their existence is not suspected, or only revealed by the above-mentioned test-paper. Whatever mischief these phenomena may commit in the way of destruction of property, their action is highly beneficial in a sanitary point of view.

M. Houzeau concludes his remarks with an announcement that he has discovered the existence of the vapor of oxygenised water (or aqueous vapor strongly impregnated with oxygen) in the air of the open country.

Lighting up of the Capitol Dome.

This enterprise which, under the direction of Mr. Samuel Gardner, of New York, has been two years and a half in progress, has been successfully accomplished, and on the evenings of the 23d and 24th ult. parties assembled to see the magnificent interior fully developed by the artificial illumination.

It is with pleasure that we announce the fact that the Capitol has been the arena of the exploit, and the experiment which has there been tried on so large a scale is demonstrated to be a perfect success. It is destined to become famous in a national point of view, and is appropriately tested in the most magnificent interior within our domains.

The central part of the apparatus is a battery of 200 jars, occupying an elliptical room 46x35 feet, and capable of being thrown on and off in sections of twenty.

The tiers of burners, at the respective heights of 45, 80 and 165 feet from the floor of the rotunda, are all invisible from thence. The respective tiers have 300, 325 and 424 burners in the order above named, and in addition to the tholus, will have 60 burners in

a vertical series of circular clusters, at a height of 264 feet from the floor; this is not yet illuminated. Total number of burners, 710.

One level of, and appertaining to each tier is a gas stop-cock, which is worked by an electro-magnetic engine in its vicinity, the power being derived from the battery.

The wire used is No. 10 copper wire, wound with linen thread and covered with india rubber tubing, secretly laid through the walls or covered from sight. The amount used is about five miles in length, and the return circuit is made through the gas pipes.

All the manipulations are performed by the operator in a passage way a few feet from the floor of the rotunda, who stands in front of a dial plate which has eleven keys.

The central key has two manipulations—one makes the battery connection, and the other brings any number of the sections of the battery into play, the range being from 20 to 200 jars. The ten keys which are ranged around the centre are for the gas and lighting connections of the respective tiers, of which three are in operation—one at the spring of the dome not yet made, and the tholus at the height of 84 feet above the eye of the dome, 264 feet from the floor of the rotunda.

The gas key appertaining to each tier has a dark and a light segment attached to it, which, showing through the orifices in the face-plate, indicates when the gas is off or on, and the motion of bringing the light segment to view makes a series of electrical connections with the electro-magnectic engine, which operates as the gas stop-cock.

The lighting key, in like manner, in its revolution, makes a series of battery connections with circuits, which embrace sections of the circle of burners. The burners, which are from six to twelve inches apart, are arranged in sections of thirty or more, each section having an independent circuit connection with the battery under the control of operator at the dial plate, who, by the revolution of the key, makes the series of connections to the consecutive sections in the tier of burners. This serial character is designed to obviate the escape of gas, which would take place were the gas allowed to extend all around the circle before any of the burners were lighted, as it would commence escaping at the burners nearest its entrance, and would be very sensibly present before it had reached the other side of the circle of one hundred feet diameter. The aim of the present arrangement is to follow the gas influx with an electric connection, which lights the gas

about as frst as it commences to exude from the tip of the burner. There would be no difficulty in arranging the apparatus to instantaneously illuminate the whole series in each tier, but would involve an escape of gas under the present arrangement.

The burners themselves have an indestructible lava tip, which acts as an insulator, and the coil of platinum wire, which by redness inflames the gas, is set a little on one side of the gas orifice, so as not to impair the jet.

The magniflicent dome and the vast proportions of the upper part of the rotunda showed to a better effect than ever before, as the windows below the spring of the dome are insufficient to irradiate the interior from the eye of the dome downwardly, and Brumidi's allegorical picture on the ceiling shows like a transparency, or like a circle of celestial scenery, viewed through an opening in the roof of an immense vault.

The apparatus is ingenious and eminently effective, and it deserves more than a mere passing notice, as well from its novelty as from the locality of its exhibition, and the fact that from here, as a centre, the invention will ramify until it embraces the area of modern civilization. Last evening the dome was again illuminated.

After discussion on Dr. Vander Weyde's important paper, the Association adjourned.

American Institute Polytechnic Association,
November 22, 1866.

Prof. S. D. Tillman, in the chair; T. D. Stetson, Esq., Sec'y.

Dr. J. Hirsh read a paper in reply to some remarks on petroleum by Dr. Vanderweyde, relating to the oxidizing of petroleum.

Steam Indicator.

Mr. F. W. Bacon exhibited a steam indicator, much smaller than McMold's indicator, and said to be more sensitive and accurate. The springs formerly employed, being of large size, recoiled when used, in consequence of the momentum acquired, further than corresponds to the steam pressure, thus giving inaccurate results. With engines of great velocity, an indicator with large springs becomes entirely useless, while the instrument employed by him always gave very accurate results:

The chairman said that for years the steam indicator was known as "Watts' indicator;" but the fact has been well authenticated

that the indicator was invented by an ingenious young clerk in the employ of Watts, at the Soho factory, where Watts' steam engines were constructed.

J. Stanley Grimes, Esq., addressed the Association as follows on

THE GREAT OCEAN CURRENTS, AND THE FORCES THAT REGULATE THEM.

It is now admitted by the best authorities that the cause of the great and constant ocean currents is the difference of temperature between the higher and the lower latitudes. The water, being heated near the equator, expands and overflows north and south toward the poles, constituting a surface current, the water of which, as it gradually cools, condenses and sinks until it becomes of the same temperature as the polar waters. A large quantity of water is also evaporated in the equatorial regions and carried poleward, probably from five to thirty degrees of latitude, before it falls again into the ocean; even then it is warm and fresh, and adds to the surface current that flows poleward. The loss of so much water in the equatorial region is compensated by the cold undercurrents that flow from the polar regions. We thus have a perfect explanation of the fact that an interchange of cold and warm currents is continually going on between the equatorial and the polar zones of the earth.

At the first thought we should suppose that these two currents would flow, one due south and the other due north; but the truth is that they are deflected eastward when moving toward the pole, and westward when moving toward the equator. The reason of this fact is now of so much importance that, although it has been stated by many authors, and may be well understood by most of my readers, I shall, notwithstanding, endeavor to explain it as clearly as possible, for the benefit of those to whom the subject is not familiar.

Effect of the Earth's Rotation upon the Ocean Currents, so far as it has Hitherto been Understood.

The poles of the earth are relatively immovable, while each spot at the equator is moving eastward about one thousand miles an hour around the earth's axis. The nearer water, or anything else, is to the equator, the farther eastward it moves in a given time; and, on the contrary, the nearer the pole it is, the less is the distance which it travels eastward in the same time. Of course, each degree of latitude has its own rate of easterly velocity. This will

be best understood if we take a round table and make it turn horizontally upon its centre; it will then appear that the nearer any object is to the edge of the table the faster it moves; that is, the farther it moves in a given time, and the nearer it is to the centre of the table the slower it moves. In this case the centre of the table represents the pole or axis of the earth, and the edge represents the equator. If we draw a straight line from the edge of the table to its centre, and place a billiard ball on the line, near the edge, and when the table is still, give the ball an impulse directed toward the centre, it will move along on the line to the centre. Now set the ball again near the edge, as before, and cause the table to turn rapidly upon its centre; let the ball again receive an impulse directed toward the centre, and it will not now move upon the same line that it did before, but will be deflected, gradually, more and more from it to one side, which we will call the eastern side. The reason of this deflection is that the ball carried with it, toward the centre, the greater rate of rotary or easterly force which it had acquired near the edge. The water which moves from the equatorial toward the polar regions of the earth is in the same predicament. Therefore, when the difference of temperature—the warmth—impels the water in a current toward the pole, the different rate of easterly velocity—the inertiæ—impels it eastward. The resultant of the two impulses is (in the northern hemisphere), a movement northeastward and (in the southern hemisphere) southeastward.

When water moves from the north polar to the equatorial region, the difference of easterly velocity causes it to move southwest. In reality it moves due south, but the rotation of the earth makes it *seem* to move southwest, because it moves *relatively* southwest. This will be understood if we place the ball at the *centre* of the table already described, and when the table is still, impel the ball toward the edge; it will move in a straight line in the direction of the impulse. Now place the ball in the centre again, and while the table is in rapid rotation, impel the ball as before, toward the edge, and we shall find that it does not pass along the line on which it previously moved, but runs, or is deflected to one side of it, we will call it the west side. The table, in fact, slips past, under the ball, in what we will call an easterly direction, leaving the ball on the west side of the line. Precisely so it is with the current that moves toward the equator. The earth is continually slipping under it, and leaving it relatively more and more west-

ward. As far as I have gone into this explanation, I have merely illustrated the true doctrines of my predecessors, without advancing any peculiar ideas of my own. The following views are of a different character, having nothing to recommend them but their own obvious merits.

NEW THEORY OF THE OCEAN CURRENTS—TWO CLASSES OF CURRENTS.

It has been assumed by all writers on the ocean currents that the water always leaves the equatorial, and also the polar regions, possessing the same rate of easterly velocity as the earth does in the latitude from which the current flows. This is not only a great mistake, but it has been the source of nearly all the errors with which this subject has been embarrassed. The truth is that there are two distinct classes of currents in the ocean, one of which may be denominated *local*, and the other *elliptical*.

The explanation of the currents already made applies only to the local currents. The elliptical currents have hitherto never been recognized as a distinct class, and the theoretical principles upon which they depend have been entirely overlooked. The two classes of currents have been strangely confounded together. The elliptical currents, when noticed, have been regarded as ordinary local currents, deflected out of their normal paths by accidental circumstances.

CAUSE OF THE ELLIPTICAL CURRENTS.

Prof. Joseph Henry, of Washington, D. C., in an article in one of the Patent Office Reports, says, in substance, that "that there are five immense circuits, or whirls of ocean currents, two in the north and south Atlantic, and two in the north and south Pacific, similar in situation, and analogous in direction and motion. In the Indian ocean another whirl or circuit exists of the same general character."

"It is not pretended," he remarks, "that the circular currents can be continuously traced, but by attentively examining the maps the general outlines and directions can be made out." Prof. Dana, in his Manual of Geology, makes the same general statement, and illustrates it by an engraving.

While these distinguished writers thus admit that each great ocean possesses an elliptical current, no explanation of the fact has been proposed, except that the currents, when moving north or south in the manner already explained, are deflected out of their normal directions, and driven into circular movements by adverse

winds, or by being forced against the opposing shores of the ocean basins. It never seems to have occurred to any author or navigator that the normal path of a great ocean current is necessarily elliptical, and that it would pursue this path if no shores or winds existed to deflect it from its true course.

According to the commonly received theory, a current which moves alternately to and from the equator and the north polar region, must flow northeast from the equator all the way to its northern terminus, as a surface current, and then return as a deep under current, running southwest. The only ellipse formed would be a vertical one; the warm current flowing above and the cold current returning immediately below it to the equator. This theory is contradicted in every ocean by more than half of the actual currents, and consequently its adherents are repeatedly forced to resort to adverse winds and deflecting shores to account for the numerous discrepancies which they encounter.

Let us take the current that circulates around the North Atlantic ocean as an example, by means of which to explain our theory, and the principles involved in all the analogous cases of elliptical currents.

When a current runs in a circle or ellipse, it cannot be properly said to have a beginning or an end; but, for convenience of description, let us say that this current commences in or near the Gulf of Mexico, at the 25th degree of north latitude, and flows north-east to the banks of Newfoundland, in the 45th degree of north latitude; it then turns and flows nearly due east, almost or quite to the shores of Europe, then south-east to the African coast, then south-west to near the equator, thence due west to South America, and then north-west to the Gulf of Mexico, from whence it started.

When the water leaves the Gulf of Mexico—the 25th degree—it doubtless possesses the easterly velocity proper to the earth in that latitude. At all events let us, for the sake of illustration, assume that it does so. Of course, according to the principles already explained, it must move north-east. When it has proceeded five degrees of latitude, and has arrived at the 30th degree, it has brought with it a greater amount of easterly velocity than the earth in the 30th degree possesses. The water of the current *differs* from the proper water of the 30th degree. Let us represent the *difference* by the number five. This surplus, or difference, the current retains, and proceeds on its way north-east. When it arrives at the 35th degree of north latitude, the difference has

increased, and now amounts to ten; at the 40th degree it is fifteen; and when the current reaches Newfoundland, or the 45th degree of north latitude, the difference is twenty.

Here the current meets the grand banks, which are commonly supposed to deflect it eastward; but when we know that it has been acquiring more and more easting from the time that it left the West Indies, and that it has now a surplus of it equal to twenty; when we further consider that its northerly force has been, during the same time, diminishing—we can readily understand that it would move almost due east from Newfoundland to the European coast, even if the grand banks did not exist.

In proceeding from the 25th to the 45th degree the current is impelled by two distinct forces, one of which acting alone would have carried it due north, and the other acting alone would have carried it due east. The northerly force is at its maximum when the current starts from the 25th degree, and gradually diminishes until it reaches the 45th degree, when it is exhausted. The easterly force—the difference—is nothing at starting from the 25th degree, but manifests itself immediately afterward, and gradually and continuously increases as long as the current runs northward. When, at the 45th degree, the current ceases to run northward, it is subject to the easterly force only. It can therefore only move due east. While moving eastward it is continually growing cooler, and therefore has an increasing tendency to move toward the equator; in other words, it begins to move south-east, and continues in that direction until the easting is exhausted. This happens near the 25th degree of north latitude. The water of the current has now become neutral, that is, it possesses no difference from the water of the earth in that latitude; and therefore, as it continues its course towards the equator, it flows south-west. When the current reaches the equator it is in a condition analogous to that in which it arrived at Newfoundland. It possesses a surplus of westerly force or westing, which may be represented by twenty. The tendency to move south is gone, but the westing or difference is at its maximum. In fact it has only a tendency to move relatively westward; and it actually does move in that direction, from the western point of Africa to the eastern point of South America. By this time the water has become so much heated that it overflows toward the north, that is, it moves north-west until it reaches the Gulf of Mexico. Its westing being now gone, it becomes neutral, that is, it possesses the same easterly velocity as the earth in

the 25th degree of north latitude. Thus the elliptical circuit of the north Atlantic is completed.

The attentive and critical observer will now perceive that a current cannot flow alternately north and south, in any ocean, without moving in an elliptical orbit, the diameter of which east and west, will be in proportion to its diameter north and south.

The two points in an ellipse, where the easterly velocity of the current is the same as that of the earth, may be called neutral points. A local current is always neutral at its starting point. When neutral water proceeds from any point to a higher or lower latitude, it accumulates a greater and greater difference of easterty velocity the further north or south it flows, provided it does not cross the equator.

We have here a perfect explanation of the fact so well known to navigators, that the currents near the equator run almost directly west, while those near the polar regions run east. We can also understand why a portion of an elliptical current, when it flows northerly from the equator, must flow north-*west*, and why such a current which flows southerly from the northern regions, must flow south-*east*.

Six Turning Points in Ellipses.

If we analyze an elliptical current we shall find that it has six turning points which deserve to be separately considered. In the northern hemisphere they may be enumerated as follows:

1. *The west neutral point*,—which in the north Atlantic is in or near the Gulf of Mexico, and in the north Pacific, in or near the China Sea. Here the waters of the current possess the same velocity as the earth. From this point the water runs north-east just as a local current would.

2. *The due east point*,—where the current has expended all its northern tendency, and where its easterly surplus force is at its maximum. In the north Atlantic this point is probably very near Newfoundland, and in the north Pacific near Kamschatka.

3. *The south-east turning point*.—This is where the current ceases to move due east, and, growing colder, turns south-easterly. This point is, in the north Atlantic, near the Bay of Biscay, and in the north Pacific, near British Columbia.

4. *The east neutral point*.—This is on the eastern side of the ellipse, where the current has the same easterly velocity as the earth has, and from which it moves south-west to the equator, just as a local cold current would. In the north Atlantic this point is

near the west coast of northern Africa. In the north Pacific it is near the coast of California.

5. *The due west or equatorial point*,—is where the current ceases to flow southward, but moves due west. Having acquired a maximum of easterly difference, or westing, and expended the force that sent it southward, it can only move directly westward. In the north Atlantic this point is near the western extremity of Africa, and about five degrees north of the equator. In the north Pacific it is about ten degrees north of the equator, and several hundred miles west of Central America.

6. *The north-west turning point*,—is where the current, being heated, overflows and leaves the equator, and begins to move north-west. In the north Atlantic this is near the point of Cape St. Roque, in South America; and in the north Pacific, it is in or near the East Indian Archipelago.

The Six Turning Points in the Elipses of the Southern Hemisphere.

In the southern hemisphere, the six turning points, though of course, the directions are reversed, are repeated in each of the three great oceans. We are not practically as well acquainted with the currents in the extreme south, as we are with the northern currents; and we cannot, therefore, point out, in all cases, with as much precision as we could wish, the localities where they turn. I have no other means of obtaining positive information concerning the actual currents than those possessed by all my readers; but, it appears to me, that when the laws that govern them are well understood, the existence and direction of a current may be indicated theoretically, in any locality, the general geography of which is known, even if no actual observations have been made. Just as an accomplished astronomer, when he is correctly informed from actual observations concerning a few points in the path of a comet, can predict its course in regions of space far beyond the scope of human vision—so the geonomer, when the principles and laws of oceanic circulation are well understood, can predict, with equal accuracy, in what direction the elliptical or the local currents must necessarily flow in any unexplored sea.

1. *The west neutral point*, in the southern hemisphere, from which the elliptical current flows southeast like a local current, appears, in the South Atlantic, to be near the mouth of the La Plata. If we rely upon theoretical principles, we must presume

that the current flows southeast from the neutral point near the mouth of the La Plata, and that it afterwards turns east and then northeast. But the truth is that we have only vague and contradictory accounts of the currents in the southern parts of the South Atlantic ; and our actual knowledge of the corresponding parts of the South Pacific is equally limited. I have a strong suspicion that the regular elliptical currents are greatly interfered with in each of the southern oceans by powerful local currents, which flow northwest from the unexplored Antarctic regions.

In the Indian ocean ellipse, the west neutral point, where the current turns to flow southeast, must be near the Cape of Good Hope, and perhaps it is within the limits of the Atlantic ocean. The current of warm water that flows south along the east coast of Africa, carries so much westing with it that it turns at least half round the Cape of Good Hope, into the Atlantic, before its westing is exhausted. Then it turns and flows southeast toward the Antarctic coast.

2. *The due east point*, in the southern hemisphere, is where the current takes an eastern direction, analogous to the current from Newfoundland in the North Atlantic. It is admitted, by all navigators, that all the currents that arrive near the Antarctic coast flow directly eastward.

3. *The northeast turning point.*—We know positively that there are three currents of warm water, one in each southern ocean, which flow toward the Antarctic coast. We know that along that coast the currents all flow eastward, and we also know that from the Antarctic region three currents of cold water flow northeast—one to the west coast of South America, another to the west coast Australia, and a third to the west coast of Africa.

4. *The west neutral point.*—It is well known that a current flows northwest from the west coast of Australia, another northwest from the west coast of South Africa, and a third northwest from the west coast of South America. All three of these currents approach very near or quite to the equator.

5. *The due west, or equatorial point*, is where the current has a maximum amount of westing, which it expends by moving relatively due westward.

6. *The southwest turning point* is where the current in each of the three southern oceans, turns from the equator, and flows southwest until it reaches the neutral point. One runs along the east coast of South America, another along the east coast of Australia, and a third along the east coast of Africa.

I have remarked that the further a current moves northward the further it must also move eastward. When this fact is realized, it becomes plain that the elliptical currents could not approach nearer the poles than they do. A current starting from the 25th degree of north latitude and impelled toward the north pole, could not get within a thousand miles of that place before it would be moving directly eastward, and as soon as it cooled it would begin to move south-eastward. This easterly tendency of the poleward currents render large polar interspaces inevitable.

I have described the currents as if they move in straight lines from point to point, but the truth is they must move in curves. The current from the west neutral point in the northern hemisphere begins by moving almost due north, then a little to east of north, then more and more easterly, until at length the easting is so great that the current moves due east. As it cools it begins to turn a little to the south of east, then flows more and more southward, until it ceases to move eastward at all, and for a very short distance it moves almost due south. But soon it begins to turn a little westward, then more and more westward, until at length it moves due west. It now begins to be heated and to turn a little northerly, then more and more northerly until it ceases to move westward and has reached its neutral point.

From this brief review it is plain that all the currents tend to move in curved lines. We can now perceive the absurdity of the idea, which is expressed in so many of our books, that the trade winds cause the equatorial currents to move westerly. The fact is that the equatorial currents generally move more westerly than the trade winds do; and the elliptical currents on their polar side, are more easterly than the winds that blow in the same latitude. This could not be the case if the winds caused the currents. In the Pacific, about ten degrees north of the equator, a counter current runs easterly, while, on each side of it, the main currents run west. If the currents here depend upon the winds blowing westward—what produces the counter current which flows directly against the wind? It should be remarked that the wind only affects the ocean a few feet below the surface, whereas many of the currents extend thousands of feet below.

Local Currents.

If two currents proceed from near the equator (or from any lower latitude to a higher), one of which is local and the other a

part of an ellipse, they will not both run in the same direction. The elliptical current will, in the northern hemisphere, move north-west, and the local current north-east. If two such currents proceed from the north towards the equator, the elliptical current will run south-east, and the local current south-west. In the southern hemisphere the same is true, but the directions are reversed. If two such currents proceed from one of the neutral points in an ellipse, they will both run in the same direction. Any one who doubts the correctness of these principles, has only to apply them to the cases of the actual currents to find that they encounter no exceptions, but that every ocean current known is perfectly accounted for by them.

I can understand that there might be a *semi-elliptical local current*, under peculiar local circumstances. If, for instance, the warm Norway current that enters the Arctic sea, moving in a north-east direction, could move unobstructed, it would flow out of the Arctic again in a south-east direction, thus pursuing a semi-elliptical path.

Each of the five great oceans contains one elliptical current, besides its local currents. The latter are necessary to give circulation to the water which is located between the ellipses, or between the shores and the ellipses. I know of no instance where a local current exists within the boundaries of an ellipse. Before the continents emerged from the sea, the water above them, not being included within the ellipses, must all have possessed local currents, the operations of which must have somewhat modified the forms of the continents.

Each of the tropical continents must have had two local counter currents; one on the north side of the equator, which moved north-east; and another on the south side, which moved south-east. The tendency of these two currents was to hollow out the tropical continents on their western sides. Thus one of the hitherto puzzling problems of physical geography is solved.

The waters over the rising polar continents must also have possessed local currents before the dry land appeared; and they must have made terrible havoc with the lands that were about emerging from beneath the sea. I imagine that each of the three great northern ellipses must have sent offsets, or local currents, into the polar sea. These currents were each analogous to the Norway current that now enters the Arctic. One similar to the Norway current entered through Behring's Strait, when that pas-

sage was unobstructed; and a current of the same character entered from the North Indian ocean.

Actual Local Currents—Norway Current.

The current that runs north-east along the coast of Norway, is generally regarded as a continuation of the, so called, gulf stream, or north Atlantic ellipse. But it appears to me to be only a local current, produced by the wants of the land-locked Arctic sea. The cold waters that flow out of that sea, along the coast of Greenland, render it necessary that a warm current should flow into it from the Atlantic. The Norway current would therefore exist, even if the gulf stream were to stop, or if it were to flow west instead of east.

If the communications of the Atlantic with the Arctic were cut off, all the water that now flows into the Arctic, through the Norway channel, would flow south-east to the African coast, and thence to the equator; in a word it would be analogous to the north Pacific current. But, as it now is, the water flows north-east into the Arctic, and would flow out again south-east, producing another "drift period," if the elevation of the coast did not present an impassible barrier. The current is forced to turn upon itself and flow out of the Arctic south-west, through the channel between Greenland and Iceland. Some writers describe the current that flows out of Baffin's sea as coming from the Arctic sea; and perhaps a very small portion of it has come through the strait of Fury; but I suspect that most of the water that flows out of Baffin's sea is the same as that which previously entered it from the Atlantic. In other words Baffin's sea is a mere repetition of the Arctic sea; which has a current flowing in on its eastern side, and another flowing out on its western side.

Guinea Local Current.

On the west coast of Africa, a local warm current is generated, which is called the Guinea current. It flows south and east into the Gulf of Guinea, beyond which it cannot now be traced. Lieut. Maury says that it goes to the Falkland islands, and warms the Patagonian coast. This is incredible. Why should a warm current like this, flowing *from* the equator, move *westward* across the south Atlantic? It is contrary to Lieut. Maury's own principles.

Cape Horn Local Current.

A current, which may be denominated the Cape Horn local current, is generated near the coast of Chili and Peru. It is analogous to the Guinea local current, and runs south to Cape Horn, between the coast and the cold elliptical current. When this warm local current reaches Cape Horn, it has acquired so much easting that it is impelled to flow eastward, around the Cape, into the south Atlantic and among the Falkland islands.

The cold current from the antarctic, which, near Peru, is known as the Humboldt current, flows north along the South American coast to Chili and Peru, chilling the climate of those shores; while the local current flows in the contrary direction, and warms the shores of the Patagonian and Fuegean coasts.

All the writers on this subject describe this great current as flowing cold from the antarctic, and "dividing into two branches," one of which, after reaching Chili and getting warm, turns back, and flows around Cape Horn. According to our theory this *cannot* be true. The Humboldt and the antarctic currents are parts of the south Pacific ellipse, and cannot flow back. The Cape Horn counter current is distinct, independent and local.

There is a remarkable local counter-current in the triangular space between the west coast of Central America and the two great elliptical currents of the Pacific ocean, about ten degrees north of the equator. It seems to be general in mid-ocean, and flows east and north, as a warm local current in that situation must. It has hitherto seemed strange and anomalous that two great equatorial currents, one north of the equator and the other mostly south of it, should be flowing constantly due west, and yet that between the two (but nearer to the American than the Asiatic coast) a warm counter-current be flowing east and northeastward. Our theory solves the engima, by showing the distinction between elliptical and local currents. An elliptical current must always flow westward near the equator, while a local current must, in the same latitude, flow eastward. There is a local current flowing in and out of the Ochotsk sea, analogous to that which flows in and out of Baffins sea; and doubtless there are other interior currents of a similar character in the Alleutian, Japan, Chinese and other minor seas along this coast.

In the Indian ocean, the elliptical current, according to the authorities, is all south of the equator. It flows from a point near the equator, and south of it, along the east coast of South Africa.

It is divided by the island of Madagascar, a part flowing between the island and the continent, and the rest flowing outside of the island; but, before reaching the Cape of Good Hope, the two divisions unite, and are then called "the Lagullas current."

It has long been supposed that this current passes entirely around the Cape into the Atlantic, and then flows north. According to the principles of geonomy, this is impossible. The current possesses so much westing that it flows into the Atlantic a short distance, and then turns and flows eastward and southward to the Antarctic coast. The actual observations of navigators seem to have convinced Lieut. Maury that this was the true state of the case, and our theory of the currents confirms the idea. Prof. Guyot has also, in his map of the world, indicated that this current flows in the manner I have described.

There is a large land-locked space north of the equator, in the Indian ocean, the water of which does not obtain its needed circulation by means of the South Indian ocean ellipse, and must, therefore, depend upon its local currents. It is said by Lieut. Maury that the Lagullas current "has its genesis in the Arabian sea;" but this cannot be true. A current that is generated in that sea must flow southeast, if it crosses the equator, and northeast, if it does not. It cannot manifest the westerly tendency that the Lagullas current does, unless it has previously flowed a considerable distance southwest. Probably the Arabian and Bengal seas send a very large proportion of their warm waters into the North Pacific, where they flow northeastward along the Asiatic coast. Prof. Guyot represents the current as flowing southwest from the Arabian sea across the equator, and along the east African coast. But according to our theory, this must be a mistake—unless the current first enters the Arabian sea *from* the south, and brings its westing with it.

According to the received theory, the warm current that flows south along the east coast of Africa should flow southeast. Its warmth tends it toward the pole, and the earth's rotation tends to force it eastward. Why, then, does it show such a strong westerly tendency, keeping close to the eastern shore of Africa, and, as it were, attempting to escape westward around the Cape of Good Hope? The old theories give no reason for this, though all authors state the fact. According to the geonomic theory, the reason is plain enough. The current comes from the Antarctic region to the equator, and brings a large quantity of westing with

it; and when returning northward, it exhibits this westing by forcing itself against the African coast, and partially turning around the Cape of Good Hope. Probably the peculiar form of the Cape—rounded on its eastern side—was caused by this current. On the same principal, Cape Horn received its form from the local current that passes around it in an eastern direction.

Season Currents of the Indian Ocean.

There are currents in the Indian ocean, north of the equator, which flow alternately in a northerly and southerly direction. These changes have been generally attributed to the influences of the monsoon or season winds; and it is possible that they have some agency in producing them, but I very much doubt it. I suspect that the same causes that produce monsoon or season winds, also produce monsoon or season currents in the land-locked seas that wash the shores of Arabia and India. When the sun is in the north, the Indian waters north of the equator are the most heated of all the seas on the globe. They are much warmer than the waters at the equator. Under these circumstances, there will naturally be a current from the equator northward, the water of which will ultimately find its way northeast into the Pacific. In midwinter, when the sun is in the south, the waters at the equator must be warmer than those along the South Asiatic coast; and local currents therefore flow southeast toward the equator. I do not believe that there is a single instance in which a constant or periodical current of the ocean is produced by the wind. The fact that the winds frequently coincide with the ocean currents, merely proves that the currents of the ocean and of the atmosphere are both produced at the same time by a common cause.

The subject of "Ocean Currents" was selected for the next discussion. It being announced that Thanksgiving would occur on the next Thursday, the Association adjourned to December 6th.

American Institute Polytechnic Association,
Dec. 6, 1866.

Prof. S. D. Tillman in the Chair; T. D. Stetson, Secretary.

The chairman opened the proceedings by presenting the following interesting summary of scientific news:

Preparation of Oxygen.

A new process has been patented in France for obtaining a supply of oxygen gas from common air by means of highly oxygenated compounds, such as chromates and bi-chromates, manganates and per-manganates, which, if deprived of a portion of their oxygen by means of steam, have the power of absorbing oxygen again when exposed to a current of dry heated air. The improvement consists in making the action continuous by placing in a retort one of the compounds mentioned, and passing into the retort a current of steam. A current of oxygen is carried off and collected in a gas-holder, while the steam is condensed to water. When oxygen has ceased to be eliminated, a current of dry, heated air is forced into the retort. The compound absorbs a portion of oxygen, and is again ready for the action of steam. Thus by the alternate action of air and steam, the same compound produces oxygen for an unlimited period. The process is said to work with great regularity, and may yet be of considerable importance in metallurgy.

To Detect Sulphuric Acid in Vinegar.

A German journal publishes a neat process, which may be thus briefly stated. Into the vinegar to be tested, put a small quantity of starch, boil the solution down to half its original measure, then drop into it a very minute portion of iodine. If the vinegar is pure, the usual blue tint will be shown; but if it be adulterated with sulphuric acid (*elasol*), no such coloration will take place, because the action of this acid upon starch converts it into glucose or grape sugar.

Osmotic Process for Separating Sugar.

In France sugar has been lately separated from beet molasses by applying the osmose principle. The membrane used is paper-parchment. Water is passed upward and molasses downward on opposite sides of the membrane.

Ozone.

Mr. G. Plante, in a note to the French Academy, states that fifty per cent. more ozone is produced in the electrolysis of water, when the poles are of lead, than when they are made of platinum. He conjectures the increase is the result of the secondary action of a layer of oxyd on the electrode.

Carbolic or Phenic Acid.

This compound (*earlat*), recently found so efficient as a disinfectant, is now used for internal disinfection, in the form of a lozenge.

Rhæudine.

Hesse has discovered a new alkaloid in the red poppy; it is also found in good opium. It is soluble in water, alcohol and ether, and crystallizes from the last in white prisms.

Parafine for Preserving Meat.

During the late meeting of the British Association at Nottingham, at one of the *soirees*, specimens of meat preserved in parafine were exhibited. The process consists in the immersion of fresh meat in parafine at a temperature of 240° F., long enough to effect a concentration of the juices of the meat and to expel the air. Afterward a coating of parafine is applied to exclude the air and prevent decomposition.

Silica in Corn-Stalks.

M. Pierre, in a memoir to the French Academy of Sciences, says some people have supposed that corn becomes laid because of the stalk from the absence of silica (*aket*), but chemical analysis does not show a deficiency of silica. Observing that corn on poor land was rarely laid, he concludes that the stalks in general give way in consequence of an over-development of leaves.

The Hardness of Silver.

M. Mathey, assayer at Locla, has shown that the hardness of which carvers in silver sometimes complain is not owing to the presence of tin, lead, or any other metal, but is solely due to the high temperature at which the silver is cast. By letting the crucible cool, until a slight solid crust is formed on the surface of the fused metal, and casting at that moment, a soft silver with a brilliant cut is obtained.

A New Test for Iodine.

M. Carey Lee, of Philadelphia, has successfully used chromates in bringing about the starch reaction in the presence of iodine in extremely small quantities. For instance, in a solution of iodide of potassium, so dilute that the addition of nitric acid or starch produces no perceptible effect, by the further addition of *a*

single drop of a dilute solution of the bi-chromate of potash, instantly produces the well known change of color.

Metallic Spectacles.

M. Foucault recently communicated to the French Academy of Sciences the fact that the sun may be viewed through a lens covered with a silver film; the sun's disk, shorn of its beams, can thus be clearly seen. Subsequently M. Melscius made a useful application of Foucault's discovery. Having been injured while making an experiment in the laboratory, his eyes were painfully affected by light. In this condition he had recourse to spectacles with black glasses, such as are used by engine drivers; over these he put green glasses, which answered pretty well; but on further experiment he found the best method was to use pale blue goggles covered with silver or gold film, and these he recommends to all persons troubled with weak eyes.

The Dead Sea.

M. Terrell, who visited Palestine in 1865, has addressed a note to the French Academy of Sciences on the chemical composition of the waters of this inland salt lake. It has been generally believed that there were no living creatures in it, but the author says he saw, in one spot, near Sodom, a number of small fish that seemed to thrive well. The following is a brief of his observations: 1. The density of the waters of the Dead sea increases with their depth. 2. Their composition and concentration are likewise variable; thus samples taken five miles east of Wady-Mrabba contain four times more calcium than those five miles east of Ras Teshkah, which contain twice as much soda as the former. 3. Samples of water from north of Sodom, in that part which forms a lagoon, contain more chloride of sodium (common salt) than chloride of magnesium, which explains why fish may live there. 4. The bromides alone seem to be concentrated much more in depths exceeding 300 meters. 5. This lake contains no iodine or traces of phosphoric acid, and but small portions of the sulphates. 6. The residue, after evaporation, examined with the spectroscope, does not show the presence of the rarer alkaline metals, lithium, cœsium or rubidium.

The November Meteors.

The long expected display of shooting stars, invisible in this country, was seen by many European observers on the morning of

the 14th of November last. To those in London and its vicinity, the meteoric shower was at its maximum about one o'clock A. M. Meteors are constantly falling into our atmosphere, where, from the intense heat generated by their rapid passage through a resisting medium, they are dissipated before reaching the crust of the earth. They are supposed to originate in a collection of isolated bodies, forming a ring or zone, which revolves around the sun either a little faster or slower than the earth. The difference in the time of their revolutions, or the year of this zone and of the earth, is about eleven days. A given point in the zone would be opposite to the earth once in about thirty-three years; consequently, it was inferred a great shower, similar to that of 1833, would be visible in 1866. On the 10th of August in every year, there is an unusual display of meteors, hence some astronomers conclude that the zone intersects the earth's orbit at a point which the earth passes on that day.

Meteorites, often found imbedded in the soil, are generally supposed to have the same origin as meteors, but, being of greater density, they are not volatilized in their descent. At least 18 of the chemical elements known to us are found in meteorites, which are classified under the names, "meteoric iron" and "meteoric stones." The former contain an average of about 90 per cent. of iron, from five to eight per cent. of nickel, and small quantities of other magnetic metals, with traces of several metalloids, generally excluding oxygen. The latter class are composed principally of silicates. Prof. Sheppard, of Amherst College, has found in meteorites several minerals not heretofore met with. Meteorites—the earth's only foreign visitors—are objects of great interest to scientists, who hope, by analysis, to learn the secret of their birth. Some persons have conjectured that they have traveled from our nearest recognized neighbor, the moon. A body would have to leave her surface with a velocity of about 7,770 feet per second, or 88 miles per minute, to pass beyond her gravitating influence, and within the superior attracting power of the earth.

Caoutchouc and Gutta Percha Cement.

India rubber, at about 400 deg. F., is converted into a glutenous mass. By the addition of fresh slacked lime to twice its weight of gum-elastic, or rubber in this state, a non-drying cement of great tenacity is formed, and is used in fastening together plates of glass so as to exclude the air, but which may easily be separated. A

drying cement is made by mixing equal weights of such gum, lime and minium (red lead). Gutta-percha, dissolved by chloroform, produces a cement now used for holding together pieces of leather. The mixture is spread on the pieces to be joined, and allowed to dry, after which they are warmed and pressed together. This cement, although water-proof, will not resist any great strain, but will be found serviceable in covering many small defects; for instance, those arising from wearing high-heeled boots, the hiding of which was the origin of the now fashionable toe-pieces. Gutta-percha soles can thus be attached to new boots, which may last for a winter. There are doubtless many other uses to which the gum cements described may be applied with advantage.

Cement for Rooms.

M. Sarel, of Paris, uses a coating for walls which is said to be superior to pure gypsum. The oxide of zinc is mixed with size, made up like a wash, and applied to a wall, ceiling, or wainscot. Afterwards the chloride of zinc, made into a wash in the same way, is applied. The oxide and chloride immediately combine and form a kind of cement, smooth and polished as glass, and possessing the advantages of oil paint, yet without any objectionable smell.

Electro-Plating.

It is said, on French authority, the addition of a small quantity of bi-sulphide of carbon to the silver and potassium bath, causes the deposit to take place with perfect evenness, and results in the production of a highly brilliant surface on the object plated.

Work of Ocean Steamers.

The wheels of the large ocean steamers make about 200,000 revolutions in crossing the Atlantic, between New York and Liverpool.

Vegetable Soap.

Mr. Payne recently brought from China to Europe specimens of the vegetable soap used throughout that Empire. It is in the form of pods, produced by two leguminous plants. Before using these pods for washing, the Chinese first cut away the greater part of the epicarp, and then rub the wet linen with the pods thus denuded, after which it is enough to rinse the linen in fresh water.

Fusee Watch Chains.

Invention has yet found no substitute for these chains, which have great flexibility and strength, and yet are exceedingly slender. Each chain is about eight inches in length, and contains upwards of 500 links of steel, rivited together. The smallest parts can scarcely be distinguished by the naked eye. They are made chiefly by young girls having very small fingers and a delicate touch. The manufacture of these chains has, for the last hundred years, been a staple article of Christ Church, Hants county, England.

Preservation of Wood.

This question, always regarded as one of great importance in Europe, is now commanding more attention in our country, where the great forests are rapidly disappearing. Various kinds of salts and paints have been used for the prevention of eremacausis and dry rot, but all are too expensive, or the methods of preparation too complicated for general application and use. The cheapest, and perhaps the most effective plan is to carbonize the surface of timber. Heat applied externally to wood, so as to char it, renders it inaccessible to fermentation, or forestalls the operation of the active principle of decay. Heat also hardens the layer beneath the charred portion, closes the pores, and prevents those essences, having the anti-septic properties of the creosote, from escaping; thus preparing the material to resist moisture and other influences that lead to decay.

Until recently, great difficulties have been encountered in applying the charring process to large combinations of worked-up materials. These have been overcome by M. de Lapparent, the Director of Naval Constructions in France. He proposed to prevent the decay of the wooden parts of vessels, caused by the introduction of steam engines, by carbonization, using therefor a jet of flame directed and applied by compressed air. His apparatus is extremely simple. Two tubes of India rubber, one leading from a reservoir of ordinary gas, the other from a bellows worked by a treadle, convey into a copper tube simultaneously both the gas and compressed air. As soon as the mixture is inflamed, a temperature sufficient to melt metals is obtained. This is simply an improved Bunsen burner, made portable. Keeping the bellows in action with the foot, all that is required is to direct the mouth of the copper tube with one hand against the surface of the wood in position, when it will be charred rapidly and uni-

formly. This process has been adopted in the French arsenals. Entire ships have thus been carbonized. Until recently, there was a difficulty in applying this process except in towns supplied with gas for illumination. A son of M. de Lapparent has overcome it by using a portable lamp, so constructed as to burn common and cheap hydro-carbons. The oil is so conducted by a single cylindrical wick of large diameter, placed horizontally at the side of the reservoir ; in the center of the wick is a pipe communicating with a pair of bellows, worked by a treadle ; a metallic chimney, pierced with holes at its base, completes the apparatus, which produces a flame quite as intense as that of the gas burner. With this arrangement, an operator can carbonize about twenty-seven square feet of oak, or twenty-two square feet of pine per hour, with a very small expenditure of oil. The French railway companies have availed themselves of the process, and apply it to most of their wooden structures. In this country, crude petroleum can be made available for carbonization ; and thus cheapened, the process should be applied in all cases where the durability of wood is of the first importance.

OCEAN CURRENTS.

J. Stanley Grimes, Esq., continued his remarks on the cause of ocean currents and the result of their action in depositing sediment. On the sinking of the ocean's floor beneath the weight of the accumulated sediment, he said that the central portions of the oceans have sunk, and that their borders have risen, is proved beyond all question. The evidence accumulated upon this subject by Darwin and by Dana, in connection with the coral reefs and islands, is highly instructive. It shows that the depressions have been gradual and continuous, in the same localities, from the earliest geological ages. Many of the geological formations also afford the most positive proofs that they were deposited while the crust of the earth—the ocean's floor—was slowly subsiding. Mr. Lyell, in his Manual of Geology says:

"The structure and organic contents of some of the ancient marine formations, point to the conclusion, that the floor of the ocean was slowly sinking at the time of their origin. The downward movement was very gradual, and in Wales and the contiguous parts of England, a maximum thickness of 32,000 feet (more than six miles) of carboniferous, devonian and silurian rock was formed, while the bed of the sea was all the time continuously and tranquilly subsiding. The sea remained shallow all the while."

"Prof. Ramsey has given me (says Darwin), the maximum thickness, in most cases from actual measurement, in a few cases from estimates, of each formation in different parts of Great Britain, and this is the result:

	Feet.
Palæzoic strata, not including igneous beds	57,150
Secondary	13,190
Tertiary	2,240

Making nearly thirteen and three-fourths British miles."

Again, Darwin says: "I am convinced that all our ancient formations which are rich in fossils, have been formed during subsidence. Since publishing my views on this subject in 1845, I have watched the progress of geology, and have been surprised to notice how author after author in treating of this or that formation, has come to the conclusion that it was accumulated during subsidence."

Mr. Dana thinks there is proof that a portion of the Apalachian region subsided not less than seven miles, before it was elevated to its present position.

Sir John Herschell and Mr. Babbage have suggested that possibly the weight of the sediment, derived from the abrasion of the shores by the ocean currents, may, in some places, produce depressions of the ocean's floor and crowd the subjacent lava up under the dry lands, thus producing volcanoes, and perhaps adding to the elevation of lands already raised above the sea. They have not proposed to account in this way for the original formation and elevation of the continents, nor have they pointed to any particular locality which they propose to prove to have been elevated in this manner. They have merely thrown out the idea as a plausible conjecture, which is not inconsistent with known facts, nor with dynamical principles. Mr. James Hall, the distinguished geologist of New York, in his latest official report, has expressed his approval of this speculation.

Without knowing anything of the opinions expressed by these distinguished authors, I was led to the conclusion that *all* elevations, including the continents, were caused by the weight of oceanic sediment. I inferred it from the remarkable relations which I found to exist between the directions of the currents and of the shores, and also the relative positions and number of the oceans and continents.

It should be remarked, that if it were perfectly demonstrated that the weight of the sediment had produced depressions, and consequent elevations, this fact *alone* would be of little value;

since it would throw no light upon the forms, number, and arrangement of the continents. But when the true theory of the ocean currents comes to be understood, the fact of the distribution of the sediment, and the depressions produced by its weight, assumes vast importance. If it is objected that I cannot directly prove that elevations are produced in this manner, and that therefore the idea is a mere conjecture—I answer, that it is true we cannot *see* the lava moving beneath the pressure of the ocean's floor, and therefore it may be said that the geonomic theory does not admit of direct occular proof; but, at the same time, to a philosophical mind, the evidence is of such a nature as to be quite as irresistible as occular demonstration. Herschell quotes from Lord Bacon, the observation that "the confirmation of theories relies on the compact adaptation of their parts, by which, like those of an arch or dome, they mutnally sustain each other, and form a coherent whole." When we consider what a vast number and variety of facts are accounted for by the geonomic theory and by no other, while not a single known fact can be found opposing it, our minds are so constituted that we cannot resist the conviction that it *must* be true.

Sources of the Sediment.

It is supposed by some authors that the ocean currents do not abrade the bottom of the deep sea; and therefore, it may be objected to the geonomic theory that, when the ocean covered the whole earth, there could not have been enough sediment collected to cause the depression of the earth's crust by its weight. It must, however, be considered, that the ocean contains an abundance of other materials for sediment besides those obtained by the mechanical abrasion of its floor. The limestone formations, some of them several miles in thickness, are composed, almost entirely, of the organic remains of creatures that have lived and died in the ocean. If it be admitted that a very small quantity of chemico-vital sediment annually settled upon the bed of the primitive sea, geology steps in with its countless ages, and magnifies the total amount to more than enough for all the purposes of our theory.

Prof. Phillips, in his Manual of Geology, 1859, London edition, p. 633, remarks: "Nothing is more certain than that of all the

* As soon as an ocean washed the consolidated crust of the globe, it would begin to abrade the surfaces upon which it moved, gradually loosening and detaching the materials to ceposit them again.—*Agassiz' Geological Sketches*.

strata yet discovered, limestone is exactly that which, by the regularity and continuity of its beds, by the extreme perfection of its organic contents and by the absence of proofs of mechanical action, gives most completely the notion of a chemical precipitate. It appears sufficiently probable, in several instances, that *the quantity of limestone deposited in a given geological period was least toward the shores, and greatest toward the deep sea;* exactly the reverse of what happens with the mechanical deposits of sandstone and shale; it may therefore be viewed as an oceanic deposit resulting from a decomposition of sea water, aided in many instances to a wonderful extent, by the vital products of zoophitic and moluscous animals."

Page 65 he says: "The deposition of limestone by chemico-vital precipitation would probably happen over a larger portion of the bed of the sea, and be *abundant in proportion to the depth, clearness and tranquility of the water; hence strata of limestone would thicken toward the center of the oceanic basin.* They would be of more uniform texture, and perhaps of purer composition, in that direction."

Page 50: "The attentive observer soon learns to consider the operations by which sandstones and clays were accumulated, as of short duration, and intermitting action; while the production of limestone is regarded as the result of one continuous and almost uninterrupted series of chemical changes.

"The carboniferous system in South Wales, which is principally limestone, is more than two and a half mile in thickness."

If any critic still insists that the weight of the sediment is insufficient to account for depressions of the earth's crust, and prefers the theory of Leibnitz, that the radiation of heat caused the internal lava to contract and the external crust to fall by its own weight; I reply, that both theories *may* be true, since one of them does not necessarily exclude the other. We may admit that the internal molten lava did cool and shrink so that the crust fell down upon it, and then ask—would it not be certain to fall, in preference, in those places where the oceanic sediment added most to its weight?

When to this consideration we add the fact that the elevations and depressions coincide with the ocean currents, is not the proof conclusive?

Professor R. P. Stevens, followed Mr. Grimes, in opposition to the novel theory which had been elaborately and ingeniously put

forth by the last speaker. Professor Stevens, in giving his own views, proposed to occupy the attention of the audience but a short time. Leibnitz, in his day, brought forth the theory that in one age the world was a molten mass, and being in this liquid condition it assumed the spheroidal shape. In process of time the crust thickened by cooling of the sphere, and so there was a space or vacuum underneath it, and the crust fell in toward the centre of the earth. (The speaker illustrated his remarks by diagrams on the blackboard.) That hypothesis has had many able defenders, and no better one than Prof. Dana, of New Haven. He would not go further, but state that he denied that the earth was ever molten, as all the facts are better explained by some better hypothesis. The chemical geologists are rapidly giving way to this new theory. He did not say that it might not have been so; he only denied, from what we know, that it was so. In Germany, after Leibneitz's time, there arose the Wermerian theory that all the rocks were formed by the agency of water. Then again the Huttonian theory that heat was the grand agent. Now he denied from any positive knowledge that we have, that any of these theories are correct. But how came continents into existence, are questions that will naturally arise. At the last and the present meeting of the Polytechnic, we had a very able theory that it was currents that produced continents. This he also denied, for we have no reason whatever to suppose that at any age of the globe there was an ocean of uniform depth, so he said there were no geological premises on which this last theory can be based.

Now, as to currents. Currents cannot create; they simply receive into their bosom, and transport whatever they receive; and when currents cease, then a deposit takes place. If the current is rapid and of great volume, it bears along with it what is heavier, and when the current ceases, as at high and low tide, then a deposit takes place; but these tidal deposits have been altered, they have been variously altered, by earthquakes and other agents, in precisely the same way that Prof. Beck's experiments have shown, and have made this entire continent just as we see it to-day.

We know that at one period of the earth's history, the point of land at St. Anthony's Nose was the *point d'appui* from which this continent in this latitude and longitude was built, and another at the Black Hills of Nebraska, and the great valley between, has been filled up, and this has been done by tidal deposits; after this

the mountains were upheaved, and so slowly that many rocks have been simply bent, not shattered. The oldest rocks that we are acquainted with are those at St. Anthony's Nose, on the Hudson. That the earth was not hot in its primary condition is proved by plants being found where they could not have existed if such was the case. The rains of heaven fell upon the old mountains, and took the *debris* and carried it into streams and rivulets, and these into larger streams, and the large into the ocean; and these tides and currents scattered it along the shore. Upon the western slope of St. Anthony's Nose there was a deposit; another age of the world went round, and the silurian deposit was made, but there was this peculiarity about these formations: when the devonian formation was 2,500 feet in thickness on the east, in the west it was but some 100 feet. The carboniferous period came next, and filled up the valley in precisely the same way that the Coast Survey says that the Raritan bay is now filling up. The changes which have been attributed to fire was due to chemical effects alone.

Succeeding the carboniferous, and part of it, was the permian, and following in order of succession was the jurassic, probably, and then the cretaceous of Kansas, Nebraska and other new inland States, to be followed finally by the tertiary, which completes the geological series. Each of these are formed in part from the *debris* of the last previous one, and wholly from those older than itself. Currents on the land and currents in the sea have been the agents of transportation only, receiving from the old, and where the currents have ceased, thus laying down their burden to be recemented to form the new.

Several gentlemen asked questions touching the new theory, in answering which Mr. Grimes occupied the remainder of the evening.

Adjourned.

AMERICAN INSTITUTE POLYTECHNIC ASSOCIATION,
December 13*th*, 1866.

Prof. Samuel D. Tillman in the chair; Mr. T. D. Stetson, Secretary.

The chairman opened the proceedings by presenting the following interesting summary of scientific news:

THE VOWEL ELEMENTS IN SPEECH.

Mr. Samuel Porter, of Hartford, Conn., has a communication on

this subject, in *The American Journal of Science and Art* occupying nearly forty pages, in which he has successfully systematized that before known, and has presented certain new relations which seem to harmonize the apparently conflicting statements of other writers. The novelty in this system is that it assigns to different places, and thus ranges under separate groups, vowels which have been commonly viewed as differing merely in degree of openness. This is ingeniously illustrated by a diagram of palato-lingual positions. This table of simple vowel elements embraces in nine groups, many modifications of vowels, as heard in some of the modern languages. The following principles are the key to the system :

I. All the vowels are articulated primarily between the tongue and palate. Some of them, those usually called labials (*old*, *ooze*, *all*, *&c.*) are further modified by the action of the lips. All are thus palato-linguals simply, or else labio-palato-linguals, and the latter consists of a palato-lingual part, capable of being employed by itself, and of a labial part which is dependant on and superadded to the other.

II. The articulation is effected as between the tongue and palate in the following manner : The organs are so disposed, and the muscles of the tongue with those also of the soft palate, so put into action as to make a firm tube or passage fitted for the reverberance of the sound which comes from the larynx. This passage so differs for all the vowels as to modify the sound in a particular manner for each—the cases excepted, of course, in which the same palato-lingual articulation makes two distinct vowels as used with or without the labial modification. The labial modification is effected by a firm contraction, and more or less protrusion of the lips, together with a right tension of the cheeks, so as to cause a further reverberation of sound, and thus give the vowel a different character to the ear; the sound is reverberated through two passages or cavities instead of one.

III. The vowels—labial and non-labial—are assorted into groups according as the palato-lingual passage extends more of less forward. The passage is either just at the throat, or is extended and lengthened by joining the lateral margins of the tongue to the sides of the palate, till finally the tube, so formed, reaches quite forward under the dome of the hard-palate, and nearly to the tip of the tongue. For the anterior groups the place is more pre-

cisely determined upon the palate than upon the tongue, owing to the extensile property of the latter.

IV. Each group thus determined embraces individual vowels, differing in *degree*, as more or less open or close. The differences are effected in the palato-lingual passage by approximating more or less to the palate the part of the tongue at the place of articulation, especially at the front terminus of the passage. The passage may at the same time be narrowed, more or less, as more or less of the margin of the tongue is put into contact with the borders of the palate. The labials will need no other or further criterion; for in their case the more or less openness of the lips will correspond to that between the tongue and palate.

Tone of Vowels.—The same author in a satisfactory manner meets certain disputed points concerning the relation of the vowels to tone or pitch. Have the vowels each what may be called in any sense their natural pitch? This, if so, can help little to a knowledge of their proper vowel characters, which remains the same under every variety of pitch. Is the peculiar character of each vowel to be explained as a certain combination of harmonic notes? This, if so, will not help much in our physiological inquiries till we have a better understanding of the mechanical conditions upon which such combinations depend in other cases. Prof. Max Müller, in reporting the discoveries of Hemholst on this point, tells us the vowel quality is to be explained as exactly analogous to the *timbre*, by which instruments, as the violin, flute, harp, &c., are distinguished one from another. But we have voices differing as do the instruments to which we liken them, yet each voice uttering all the vowels and giving to every one its peculiar character. We cannot, therefore, accept this as an adequate explanation.

There are two or three facts under this head which, if not already familiar, can be easily verified. *First:* If we utter in succession any two or more of the simple vowel elements, we shall find them naturally taking a different pitch one from the other; and referring to the series of groups arranged according to the place of articulation as reaching more or less forward upon tongue and palate, we find that, in passing from any vowel in the scale to one further forward and similar in degree of openness, the voice rises in pitch, while, proceeding in the other direction, it as naturally falls. The following is proposed as a physiological explanation of the fact. The movements of the tongue have an influence upon those of the larynx, through the intermediation of the hyoid

bone, a movable fulcrum with which both organs are connected by muscle and ligament. The connection is such that a movement of the tongue will require a readjustment of the muscles of the larynx, to keep the latter organ in the same place and condition as before, and so observe the same pitch. Hence, through the two, successive vowels *can* be uttered on the same pitch, and it is much more easy and natural to vary the pitch. *Second:* Every singer knows that only with certain vowels can the extremely high notes be fairly reached, and only with certain others, again the lowest. The connection just mentioned between the tongue and the larynx will suffice to explain this also, though we would not affirm that there is no other cause concurrent therewith. *Third:* The vowels cannot be uttered on every pitch with equal purity of tone, and there would seem to be one certain key for each, on which the purest tone is heard—the purest musically, we mean, that is, the most free from discordant intermixture. The same cause above mentioned may have an agency in this case also, but the author thinks that here the effect may be due primarily to the form and dimensions of the vowel-tube.

Indium.

This rare metal was first discovered about three years ago by Messrs. Richter and Reich of the Frieburg Mining Academy, in the zinc blende, in the vicinity of Frieburg. It has lately been found by M. M. Kachler and Schrotter, in the blende at Schonfeld, near Schlagenw. M. Winckler considers it best, in extracting indium, to treat the roasted blende by hydrochloric acid, to precipitate by an excess of zinc the indium, copper, lead, cadnium, &c., and to seperate these metals by sulphureted hydrogen and carbonate of baryta. M. Schrötter modifies the method by treating the blende, after roasting, with sulphuric instead of hydrochloric acid, precipitating the indium by zinc and fractioning the precipitates; the purification of indium is then easier in consequence of this division. Indium may be ranked among the heavier metals; its specific gravity being from 7.11 in the granular state, to 7,28 after hammering. Its color resembles that of platinum. Its luster is not tarnished by exposure to air or even to boiling water. It is softer and more malleable than lead, and is as volatile as magnesium or zinc. It forms but one oxide. Its salts are colorless, but when exposed to the flame of a Bunsen burner, impart to it a blue or violet tinge. In its electric properties indium resembles cadnium, but is more electro-negative.

A Test for Gilt.

Weber states that a solution of common chloride of copper will not affect articles covered with gold-leaf, but will leave a brown stain on those covered with gold colored alloys.

Food for Plants.

Mr. Illienkof, a Rusian chemist, recommends the use of 40 parts of ground bones, 40 parts of wood ashes, and six parts of newly made lime, with water enough to thoroughly mix the whole.

Perchloride of Iron for Cancer.

At the Medical Congress of Bordeaux a paper was read by M. Bitot upon the treatment of cancer. The author considers that perchloride of iron (*ferramid*) is a specific for cancerous affections; its action being like iodine in cases of scrofula; the perchloride should be employed both internally and externally in order to affect both the diathesis and the diseased parts.

Photographic Colors.

A correspondent of the French *Repertoire de Photographie*, writing from South America, says: "Some time since, I took a positive portrait of *my wife* on glass. The weather was very fine, but on coming out of my dark room I observed that the light appeared very yellow and somewhat obscured, and I then remembered that there was a total eclipse on that day. After developing and fixing my positive I found all the colors of my wife's dress faithfully portrayed on the film. The dress was of blue flowers on a black ground, the cap trimmed with blue and yellow ribbons, and all these colors were accurately reproduced, even the flesh tint of the face and hands were perfect. Unfortunately, all these colors disappeared after a lapse of ten minutes." The writer does not say whether any besides himself saw this portrait of his wife. This is, however, only one of many cases of evanescent coloring reported within a few years.

Deville's Furnace.

M. Deville, of France, has constructed a furnace of great heating power. It consists of a flame of coal gas, inclosed in a chamber of non-conductors, into which a jet of oxygen gas is blown. In this way only the material required for perfect combustion is admitted, thus obviating the objection to the use of common air which involves the necessity of introducing into the

furnace with every volume of oxygen four volumes of inert nitrogen. When cold air is used, part of the heat generated by oxygen is wasted in heating the nitrogen; it has therefore been found highly advantageous to apply the waste heat of the furnace in raising the temperature of the air which feeds the flame, thus forming what is technically called the *hot blast.* The use of pure oxygen is not economical, but where a very high temperature is required, it is indispensable. In Deville's furnace, platinum, the most refractory of the elements, when placed upon a bed of lime and subjected to the flame is easily melted. About one cubic foot of coal gas and one of oxygen will reduce one pound of platinum. The temperature generated in the Deville furnace has been estimated to be over 14,000 degrees Fahrenheit, or about five times higher than that required to melt cast iron.

Carbonate of Soda.

A new process for producing this important salt has been patented in Great Britain by Mr. Walter Weldon. It consists in placing within a strong vessel equal equivalents of common salt (*sodamad*) and carbonate of magnesia (*magmarit*), with a small quantity of water, and pumping into the vessel carbonic acid, formed by passing atmospheric air over ignited coal. The carbonate thus becomes the bicarbonate of magnesia, which dissolves in water and thus decomposes the chloride of sodium. The chlorine unites with magnesium, forming chloride of magnesium (*magamad*), at the same time biçarbonate of soda (*sodmarit*) is formed and precipitated. The whole process lasts but a quarter of an hour. A moderate heat drives off the second atom of carbonic acid, thus changing the bicarbonate into carbonate of soda (*sodemarit*). By evaporating the solution of chloride of magnesium to dryness, and raising it nearly to a red heat, the chlorine is driven off and magnesia is formed.

America now imports every year several million dollars worth of carbonate of soda from England, where it is made by the use of common salt, sulphuric acid and chalk, according to the process of Leblance, invented toward the end of the last century.

Calcutta Copal Resins.

The *Comptes Rendus* contains some new researches by H. Violette on those resins, which previously had been found soluble in ether, turpentine, benzole, petroleum and other hydro carbons, as well

as vegetable oils, only after losing about 25 per cent of their weight by distillation. Violette's experiments show that these resins, heated in a closed vessel at a temperature between 350 and 400° C, or 662 and 752° Fahr., acquire after cooling, without losing any of their weight, the property of dissolving, hot or cold, in the above named liquids, and forming excellent varnishes. He finds also that Copal resin, heated as stated, under pressure, with one third of drying linseed oil and one-third of essence of turpentine, gives directly, without loss, a rich, clear limpid varnish of a beautiful slightly lemon color, perfectly adopted for carriages, and for the inside as well as the outside of rooms, where delicate painting is required. Under the double influence of heat and pressure this resin acquires new properties. Manufacturers who would take advantage of this discovery, must bear in mind the retort used will be subject to a pressure of at least 300 lbs. to the square inch.

New Inventions.

Dr. J. B. Rich exhibited a new screw wrench, which he had tested and found to be a valuable invention. It could be adjusted while in use with one hand, and he thought it was the most convenient tool of the kind he had ever seen.

Mr. Buchanan exhibited an electrotyped embossing stamp, which was favorably spoken of.

The new water-proof letter envelope, used at the United States Patent office, was also shown; it is made of paper coated with India rubber varnish.

Gold Dredger.

Mr. J. Johnson, of Saco, Maine, exhibited a model of his apparatus for dredging rivers for gold, which he intended to put in practical operation in one of the rivers of Georgia. It consists of a centrifugal pump, connected with a pipe long enough to touch the bottom of a river, while the pump was operated by steam on a boat. He thought that almost every new substance found on the bottom of a river could be brought up. He showed by experiment that weight was no obstable, it merely impeded the speed.

Mr. J. K. Fisher suggested that a similar apparatus might be used for cleaning city sewers.

Mr. W. Lee said he had used for years a similar method in searching the bottom of the sea for sunken treasure. His principal experiments were made in the Black Sea, in the harbor of Sebastopol. He found that the centrifugal pump drew up every thing that came in its way.

Mr. F. A. Morley made the following remarks :

ON THE GULF STREAM.

The cause of that prominent phenomenon, the Gulf stream, and its immense propelling power, lies buried in mystery to this late day, and no sufficient agency has yet been assigned therefor. The theory or explanation offered by Dr. Franklin many years ago, seems to be the most plausible one, and is the one that has been generally accepted ; but it is totally inadequate to produce such a result, and must sooner or later give way to some other explanation.

The cause of the Gulf Stream, according to Dr. Franklin, is that the waters in the Carribean Sea are piled up by the trade winds, and from thence escaping through the Florida Straits they are sent out with a momentum sufficient to carry them across the Atlantic. Any person acquainted with the action of wind upon water, knows that it only affects the surface, and that this action is readily compensated by a counter current or "undertow." A piling up or head of water greater than three of four feet, could not be steadily maintained unless all the channels, through which the waters are blown in, were very shallow, which is not the case. It seems too plain to need proof that a discharging velocity of four miles per hour past the capes of Florida could not carry this water to the coast of Norway. Besides, if such were the cause of the Gulf Stream, how are we to account for similar warm water currents in other parts of the earth, where there can be no piling up of the water? There is a warm water current in the open sea east of South Africa, and running southwest from the Indian Ocean. It is further known that there is an immense warm water current running from the Pacific southward, passing near to and to the eastward of the great island of Australia, as it seeks the icy barriers of the Antarctic; also the Chinese or Japan current, running northward, and much resembling the American Gulf Stream. None of these currents are due to accident, such as the piling up of water in a bay or hight of the land. There must be some general law applicable to all these currents. The conviction that present explanations are insufficient, led the speaker to give the subject considerable attention, with the hope of finding one more satisfactory. And he now proposes to show that, in effect, the Gulf Stream has a fall of about 250 feet, and of course that its propelling power is equal to a head of water of that height.

The speaker commenced his explanation by quoting from Olmstead's Philosophy: "The centrifugal force of bodies revolving in a given circle, is proportional to their densities or specific gravities. If quicksilver, water and cork be whirled together in a pail or glass vessel, these bodies will arrange themselves in the order of their specific gravities, so that the cork will be at the least, and the quicksilver at the greatest distance from the center of motion."

Let the earth represent this pail or glass vessel, or rather let the northern hemisphere represent one basin containing water, and the southern another. To save repetition, only the northern hemisphere will be referred to. The equator would be the rim of the basin and the North Pole the center. We have the revolving motion in the diurnal motion of the earth. The light and heated water represents the cork, and cold water the quicksilver. As cold and heavy water is thrown from the North Pole to the equator, that is, from the center of the whirling basin to its rim, it becomes heated; and as it moves from the equator to the pole, or from the rim of the basin to its center, it becomes cooled. These changes of temperature and specific gravities are constantly taking place, consequently, these changes of position must also be continuous, keeping up a constant exchange of water between the pole and equator. The fact that these currents are concentrated and more or less confined to localities, is owing to the continents, which break the surface of the water surrounding the earth. The reason why their line of flow is not directly north and south, is too well understood to dwell upon here.

The American gulf stream rises in the Gulf of Mexico, and maintains a distinctive character as a river in the ocean for over 2,000 miles, and is not fully lost until it approaches the coast of Norway, a distance of over 4,000 miles from its source. Its width in the narrows of Bemina, or off the Florida capes, is 32 miles, and its velocity four miles per hour; its width off Cape Hatteras is 75 miles, and its velocity three miles per hour. This is a very respectable velocity, and quite up to the average velocity of large inland rivers.

The navigable portion of the Mississippi is 2,700 miles in length, and has a fall of 600 feet; and its current is not swifter than that of the Gulf stream. Now, that we have glanced at the propelling power of one of the largest rivers in the world, and found its moving power to be a head of water 600 feet in height, let us inquire into the propelling power of that "mighty river in the ocean,"

the Gulf stream, whose waters are a thousand times the volume of the Mississippi, and not less rapid in movements or less extended in length of travel. As before mentioned, the Gulf stream has a fall of about 250 feet; this is not so great a fall as that of the Mississippi, but that stream flows through a very crooked, rough and comparatively narrow bed, making the friction much greater, which disposes of the excess of propelling power in that case. The actual propelling power of the Gulf stream is susceptible of being calculated with considerable accuracy, when we know the temperature of its water and the temperature of the ocean upon each side of it. The polar diameter of the earth is 26 miles less than its equatorial diameter, and the surface of the ocean at the equator stands about 13 miles higher than at the poles. This protuberance is caused, of course, by the centrifugal motion of the earth. Now, the important fact in this proposition is this, when the waters of the ocean are cooled and become heavier, then the centrifugal protuberance of the ocean becomes greater, or is increased; and if the whole ocean were heated, and of a less specific gravity, then this protuberance becomes less. If by any means the gravity of the waters of the ocean could be entirely annihilated, then the equatorial protuberance of the ocean and its gravity would both run out to nothing, and disappear at precisely the same time. This, at first sight, may seem rather problematical, but it is, nevertheless, a fact. It is true that when the equatorial protuberance is increased by cold and heavy water, the water has greater gravity to contend with at the same time that its centrifugal power is increased, but as the water rests upon the floor of the ocean, its increased gravity can only act on an inclined plane—which is, from the equator to the pole, 6,000 miles in length—and this increase of gravity has less than one-fifth of one degree of direct action; while on the other hand, the increase of centrifugal force acts more directly, or at a resultant angle of 45 degs., and consequently gains very rapidly in power over such opposing gravitating force, when the weight of water is increased. The result is; that the protuberance of the ocean is increased with its specific gravity. The comparative power of the two forces is this: If a cubic rod of water has its specific gravity increased 461 pounds, then this increased gravity can oppose an increase of protuberance only to the extent of one pound of direct force; while the centrifugal power or force is directly increased 230 pounds, leaving a clear gain of 229 pounds of centrifugal force

over the opposing gravitating force ; and this gain of 229 pounds is expended in adding 229 pounds of water to the protuberance of the sea, and when this has been done, then the forces are again *in equilibrio*. This result is readily calculated from the two angles at which these forces are brought to bear. Then, of course, it is plain to be seen that the level of the sea is disturbed by change of its specific gravity, and if only a part has its specific gravity changed while the main body remains neutral or unchanged, then that part which alone is affected must act for itself.

But let us resort to figures to show the propelling power of the Gulf stream. Maury, in his "Physical Geography of the Sea," speaking of the Gulf stream, says: "There is off Hatteras, and even as high up as the Grand Banks, a difference of temperature between the waters of the Gulf stream and the ocean upon either side, of from 20° to 30°." Let us take a point anywhere between these two points—say directly opposite the port of New York—and suppose the temperature of the Gulf stream to be 25° Fah. above the temperature of the ocean upon either side of it. Water, at a temperature of 55° raised to 80 degrees, changes its specific gravity by expansion 1-282d part. The centrifugal protuberance of the ocean, at this point of estimate, is about ten miles, or three miles less than at the equator. Now, as the waters of the Gulf stream at this point are 1-282d part lighter than the ocean upon either side, it is also 1-282d part of ten miles of protuberance above the proper level for water of its temperature and specific gravity. The ten miles of protuberance is 52,800 feet, and 1-282d part of this is 187 feet: consequently the colder water, or main body of the ocean, is holding the Gulf stream up, at this point of estimate, 187 feet above the true level for water of its specific gravity. Or, in other words, if the ocean at this point were of the same temperature as the Gulf stream, then its protuberance level would be 187 feet lower than it now is; consequently the Gulf stream is to all intents and purposes, running down hill towards the pole, and this hill at the capes of Florida is about 250 feet high, and at the New York latitude 187 feet high. This is the cause of the Gulf stream, and is also the main cause of all permanent oceanic currents, both warm and cold.

Cosmogony.

Dr. Vander Weyde gave, by request, his views on Cosmogony, and said:

The hypothesis of La Place and Kant is, by the modern discoveries of the conservation of forces, elevated into a theory; it is this: In the beginning, all atoms were diffused in the infinite space; by contraction they have collected in different centres, which now constitute the millions of suns and planetary systems. When we compare the mass of our planetary system with the space it occupies in the universe between the fixed stars, and imagine that its atoms were again diffused as a nebula, a simple calculation shows us that every single pound of matter would have forty millions of cubic miles to expand in, thus constituting a nebular substance by comparison of which our hydrogen is very coarse and heavy, as a pound of pure hydrogen only occupies 160 cubic feet; common, impure hydrogen is much heavier. This exemplifies, in the most striking manner, that however enormously great the heavenly bodies appear to be to us, the space in which they move is much more immense.

One of our greatest astronomers, Maedler, expresses himself thus: "What at present is only a nebular spot in the heavens, will once shine as a galaxy, and there was once a time that nothing existed in the universe but limitless nebular masses." This, in part, is the true chaos of the ancient philosophers.

The same Maedler* was the first who, 30 years ago, announced to the scientific world that the enormous gravitation of the mass of the sun itself, and the resulting compression of all its constituent parts, must necessarily develop heat and light, and I think we may go a step further, and say that the falling together, the coalescense of the enormous amount of matter which now constitutes our sun, must necessarily have developed heat enough to last for some millions of years. The French naturalist, Buffon, more than a century ago, and Bischof recently, made a series of experiments about the time necessary for large balls of different sizes, made of cast iron and of basalt, to cool down from the white or red hot state, trying to find the law of the relation between their size and the time required for this cooling, deducing at last from these experiments the conclusion, that for a body of the size of our

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* Maedler is a German by birth, and Imperial Russian astronomer at Dorpat. See his Popular Astronomy, Berlin, 1841, 4th edition, 1847, page 127.

sun, it would take many millions of years to cool down to any perceptible degree when once in a white hot condition.

Modern experiments prove that no motion can be obstructed without the generation of heat, from there the use of lubricators preventing heating of the parts, and the consequent loss of motive power; that heat is generated when a body falls from a height on the ground, and that any small amount of heat, developed by the shock, may be measured to a small fraction of a degree, is one of the triumphs of modern philosophy.

The Doctor here explained Melloni's method of measuring the one-thousandth part of a degree by the thermo-electric pile and multiplicator; illustrating the explanations by experiments.

If now we see that we cannot drop this leaden ball on the floor, from the height of a few feet, without raising its temperature, we can imagine what will be the result of the falling down to a common centre of gravity of millions of billions of masses, through spaces of millions of miles, with velocities far surpassing anything we can produce, and we must conclude that an enormous rise of temperature must take place, of which we cannot possibly have any conception.

This force is now radiating into space, and is giving back slowly, in the form of caloric and luminous undulations, a part of the power expended by the falling down or evalescence of the masses.

Heat, as we know now, is a state of matter, a molecular motion, vibratory or rotatory, and the motion of the masses once produced by gravitation toward certain centres, is now returning into space, producing molecular motion, all around, at enormous distances. We say vibratory, rotatory or undulatory motions, as the hypothesis of Newton, that light and heat is propagated by fine, material particles, emanating from and propelled by the luminous body, is just as absurd as it would be to assert that sound is produced by fine material particles driven out by the sounding body.

A small fraction of the waves continually produced by the molecular motion or heat from the sun reaches our earth, less than one-ten-thousand-millionth part, and this small fraction of its heat and light is the source of all vegetable and animal life, of all the motive power, of every movement we see on the surface of our planet, except the tide-wave in the ocean and in the atmosphere. We may, in fact, trace back to the sun all water power, as it is produced by atmospheric evaporation; all wind power produced

by the unequal heating of the atmosphere; all steam power produced by fuel, or animal power requiring food, both fuel and food produced by the developing power of the magical sunbeam in producing vegetation. Can we, then, wonder that there were nations who worshipped this great celestial luminary, as the source of all life, and that the day dedicated to the chief of the old seven planets, from which our Sunday is derived, was already a sacred day among the pagan nations, when Christianity was first established in Southern Europe and Western Asia?

The Dr. described the latest discoveries with the spectroscope, which settles the matter beyond any doubt, that the sun is in a fluid condition, not alone, but at such a high temperature that substances solid on our earth's crust, are there present in the state of vapor; that the sun, in fact, is surrounded by an atmosphere consisting not of nitrogen or oxygen like our earth, but so hot that it consists of the vapors of zinc, sodium, potassium, not alone, but of chromium, barium, nickel, copper, and even iron vapors in large quantities. Also, that the light specific gravity of the sun's mass corresponds strikingly with that of the liquids into which we are able, by means of great pressure, to condense almost all gaseous substances, with only a few exceptions; so that it is highly probable that the interior of the sun consists of liquified gas, kept in that state by the enormous pressure of an atmosphere of immense mass and weight.

The Dr. finally reviewed the geonomic theory, explained at the last meeting by Prof. Grimes, mentioning several instances to prove that it is not supported by the well known mechanical laws, nor by the geological data: after which the Association adjourned.

American Institute Polytechnic Association, *Dec.* 20, 1866.

Professor Samuel D. Tillman, Chairman; Mr. Thomas D. Stetson, Secretary.

The chairman opened the proceedings with the following scientific summary:

Persistence of Rays.

An experiment by Abbé Laborde seems to show that waves in the sunbeam, of higher velocity, producing the perception of blue, make a stronger impression than waves of low velocity. A ro-

tating disc of metal having slits in its circumference so as to admit and intercept the solar beam, is placed in a dark chamber, between it and the observer is a ground glass screen to receive the beam. When the disk rotates slowly the separate appearances of the beam are distinguished. At higher velocities the image of white light is tinged with blue, green, rose, white, green, blue, in this order. After the second blue, the image is white at all higher velocities of rotation.

Remains of a Gigantic Dinosaur.

Professor E. D. Cope exhibited at the Academy of Natural Sciences, Philadelphia, the remains of a gigantic extinct Dinosaur, from the cretaceous green sand of New Jersey. The bones were portions of the under jaw, with teeth, portions of the scalpular arch, including supposed clavicles, two humeri, left femur, right tibia and fibula, with numerous phalanges, lumber, sacral and caudal vertebræ, and numerous other elements in a fragmentary condition. In size this creature equaled the Megalosaurus (70 feet in length), and must have been one of the most formidable of the rapacious terrestrial vertebrates. The remains were found by the workmen under J. C. Voorhees, superintendent of the West Jersey Marl Company, about two miles south of Barnesboro', just under the stratum of green sand (now used as a manure), and about twenty feet from the surface.

Mount Hood.

This mountain, the highest of the Cascade range, situate about seventy miles east of Oregon City, was visited in August last by a party of six gentlemen, who ascended to the summit. One of them, Professor Alphonso Wood, gave a detailed account of the trip before the California Academy of Natural Sciences. He measured various altitudes, by observing the boiling point of water, as follows: Summit of the Cascade range and foot of Mount Hood proper, 4,400 feet; the limit of forest trees, 9,000 feet; highest limit of vegetation, 11,000 feet; summit of mountain, 17,600 feet. He describes a crater of great extent, the west side of which is still an open abyss, whence issues constantly volumes of sulphurous smoke. He estimates the depression of the ancient crater at not less than 1,000 feet. The summit area is a crescent in shape, half a mile in length and from three to fifty feet wide. It is a fearful place; on the north side is a precipice

a vertical mile of bare columnar rock! He states that this is the highest measured point in the United States, if not in North America. He found true glaciers on the flanks, with terminal and lateral moraines.

On Nitrogen from Manures.

Mr. J. B. Lawes, F. R. S., and Dr. J. H. Gilbert, F. R. S., have been engaged for many years in making experiments, in the course of which they had grown wheat, year after year, on the same land, for more than twenty years, on some portions without any manure, and others with various kinds of manure. The results obtained have been published. In a paper presented by them at the late meeting of the British Association, they directed attention to the accumulation and the loss of the nitrogen, which had been supplied in the manure, and not recovered in the increase of the crop. The general result of their investigation was that although a considerable amount of the nitrogen of the supplied manure, which had not been recovered as increase of crop was shown to remain in the soil, still a larger amount was as yet unaccounted for. Initiative results indicated that some existed as nitric acid in the soil, but it was believed that the amount so existing would prove to be but small. In fact, it was calculated that a considerable larger proportion would remain entirely unaccounted for in the soil than there was traceable, and the probability was that at any rate much of this had passed off into the drains, or into the lower strata of the soil. Finally, it was shown, by reference to the field results, that there was not more than one or two bushels of increase in the wheat crop, per acre, per annum, due to the large accumulated residue of nitrogen in the soil, notwithstanding its amount was many times greater than that which would yield an increase of twenty bushels or more, applied afresh to the soil otherwise in the same condition. On the other hand, it was shown that the effect of an accumulated residue of certain mineral constituents was not only very considerable in degree but very lasting.

Treatment of Seaweed.

The British Seaweed Company are carrying into practical operation at their works in the outer Hebrides, Stanford's process for treating seaweed by destructive distillation. Instead of the fused ash called kelp, which is prepared in contact with the open air, and from which all the iodine has been dissipated, Mr. Stanford

produces a highly porous charcoal, retaining the whole of the iodine, by subjecting the seaweed to a low red heat in a closed iron retort. The original sea-tangle thrown upon the shores of these islands in the winter consists of large stems, each about eight feet long and one and one-half inches in diameter. These, when dried, shrink to about half an inch in diameter, and closely resemble horn. After carbonization they expand to about three-fourths of an inch in diameter, and contain about forty per cent. of salts. When the charcoal is lixivated, fine colorless specimens of salts are obtained, consisting of chloride of potassium, sulphate of potash, iodine, bromine, and iodide and bromide of potassium. The products of distillation saved are chloride of ammonium, sulphate of ammonium, tar and pitch from the tar, oils, acetone, naphtha and gas which is used for illuminating the works. The charcoal, from its high porsity, is introduced as a deodorizer; its chemical composition resembles that of animal charcoal, rather than vegetable charcoal. This is especially interesing, as tangle, being a pure alga, is close to the border line, separating the animal from the vegetable kingdom. This charcoal can be afforded at about one-fourth the price of the animal charcoal.

On the Sources of Fat in the Animal Body.

The authors last named presented a paper on this subject at the last meeting of the British Association for the Advancement of Science, in which they briefly viewed the opinions of eminent scientists. In 1842 Baron Liebig had concluded that the fat of herbivora must be derived, in great part, from the carbohydrates of their food, but might also be produced from nitrogenous compounds. Dumas and Boussingault at first opposed this view, but subsequently the experiments of Dumas and Milne Edwards with bees, of Persoz with geese, of Boussingault with pigs and ducks, and of the authors with pigs, had been held to be quite confirmatory of Leibig's view, at any rate as far as carbohydrates were concerned. But at the meeting of the British Association in 1864, Dr. Hayden expressed doubt on the point; and at the Congress of Agricultural Chemists held in Munich last year, Professor Voit, from the results of experiments with dogs fed on flesh, maintained that fat must have been produced from the nitrogenous constituents of the food, and that these were probably the chief if not the only source of fat even in herbivora. Baron Leibig disputed this conclusion, and his son, Hermann v. Liebig, had since sought to

show its fallacy by reference to experiments with cows. The authors, although agreeing with the conclusions of H. v. Liebig, thought his data were inadequate. They exhibited numerous tables showing the results of their experiments with pigs, from which the following conclusions were drawn:

1. That certainly a large proportion of the fat of the herbivora, fattened for human food, must be derived from other sub-substances than fat in the food. 2. That when such animals were fed on the most appropriate fattening food, much of the stored-up fat must be produced from carbohydrates. 3. That the nitrogenous constituents may also serve as a source of fat, more especially in defect of a liberal supply of the non-nitrogenous ones.

Work Done in Rowing.

The work done by the crew of the prize-boat, at the last Oxford and Cambridge boat-race, has been calculated by Prof. Samuel Haughton, F. R. S., from the following data:

Length of boat	56 feet.
Greatest width amidships	2 feet.
Greatest depth	$12\frac{1}{2}$ inches.
Thickness of plank	$\frac{1}{8}$ of an inch.
Weight, including oars, &c	350 lbs.
8 men, average weight of each	158 lbs.
Weight of coxswain	112 lbs.

Length of course, one knot, rowed in seven minutes.

He found the total work done was 224.57 foot-tons. The work done per man was 28.07 foot-tons in seven minutes, and 4.01 per minute. The power was applied through oars traversing in the water eight feet; the short arm or handles of each oar being three feet five inches, and the long arm nine feet. The distance from the stretcher to the seat was about 3 feet.

A good idea may be formed of the rate at which the muscles give out work in a boat-race, from comparing the work with the average daily work of a laborer. At most kinds of labor there are 100 foot-tons of work accomplished in ten hours. In a boat-race the oarsman produces in *one minute* the hundredth part of his day's labor, and if he could continue work at the same rate he could finish his task in one hour and forty minutes, instead of the customary ten hours.

Mr. J. Scott Russell has published in *The London Practical Mechanics' Journal* the result which his methods and formula give for a boat of the same dimensions, if the boat were considered of a wave form. The work done in this case being, per man per minute, 3.59 foot-tons. The editor of *The London Practical Mechanics' Journal* says, the result showing the great excess of labor for the unit in time, over and above that of an average day's work, is by no means startling, especially if reliance is placed upon the experiments of the late Mr. Robertson Buchanan, showing that in the following modes of applying muscular effort, rowing is the most advantageous of all others in the ratio of the annexed numbers :

Pumping	100.	Bell-ringing	225.
Turning winch	167.	Rowing	248.

The value of the investigation causes us the rather to desire that the actual resistance to traction of the Oxford race-boat, loaded as with her crew and *at her race speed*, should be experimentally ascertained. A good deal of valuable information but very little known in England, on the subject of human force, and the relation between its absolute force or energy, and the velocity with which it is given forth and the time of its endurance, will be found in Bougner "Manœuvres des Vesseaux," and in Euler's Memoirs in the Transactions of the affairs of St. Petersburg, New Series, Vols. III. and VIII., in the last of which he examines the animal mechanics of rowing. Schultz's experiments in the Memoirs of the Academy of Berlin for 1783, also are probably the most complete that have ever been made upon human effort, and especially in reference to the relation (for a given form of muscular exertion), between height, weight and absolute force in the man, and the result in work. This applies, in a very direct way, to the much debated question among oarsmen, as to what average size and weight of men in an eight-oar boat ought *cæteris paribus*, to give the best results of speed. The Oxford view is, we believe, that heavy men (eleven to twelve stone) give the best results, and this seems supported by the facts of their actual weights of crews and their general success. With heavy men especially, but, in fact, with men of all weights, there can be scarcely a doubt but that the proper proportioning the rate of stroke, so that the trunk of each man, as he oscillates, shall move as a pendulum pivoted on the hip joints, and, therefore, with the least effort; and the

right proportioning of the length of oars, and all else, to give to the muscular effort expended *the fullest value at this rate*, has a by no means insensible effect upon the issue. A view which appears supported by the measured stroke of Oxford against the quicker rate of Cambridge.

Hachette, "Traite des Machines," and the late Mr. B. Bevan, C. E., have given also some important experimental results as to animal efforts continued for long and short times, and Professor Leslie has placed on record some curious observations on this subject. The sedan chairmen of the last century were accustomed to go along for half an hour, at the rate of four miles an hour, under a burden of 300 lbs., not always equally divided between them, and a case is on record (how trustworthy we cannot say), of half a mile having been done in five minutes and some seconds. For a short distance, say not more than 100 or 150 yards, the porters of Constantinople, or the *fachines* at Marseilles and other Mediterranean ports, do not refuse a burden of seven or eight hundred weight, carried on the back, with which, in a stooping posture, and sometimes aided by a staff in one hand, they travel at the rate of probably two miles an hour, if not faster.

THE HYDRODEIK.

The improved hygdrometer, the invention of Mr. Edson, was exhibited by its manufacturer, Mr. N. M. Lowe, of Boston, Mass., who made the following statement:

It has long been known by observing men that air is not healthy, or comfortable, unless it contains a certain amount of moisture—too much or too little being equally unhealthy—and every one who has given much time and thought to the subject of ventilation must be aware how essential it is to know, from some other source than from our own ever-varying feelings, the real state of the air in which we exist, and upon which our life and enjoyment depends. To assist in the solution of this problem, is the object of the hygrodeik.

In the sitting room, school-room, and sick-room, this instrument is invaluable, as it shows at once if the air is in an unhealthy state, and points out the remedy. In conservatories, grape-houses, &c., it is very valuable, as it will enable a comparatively inexperienced person to keep the air in a healthy condition for the plants, and thus avoid the pests of mildew and insects. In cotton mills, also, it is necessary to maintain a constant degree of moisture, or the

threads will become dry and highly charged with electricity, which causes the fibres to stand out from the threads and thus renders them liable to be broken.

It is believed that, with slight experience, with this instrument as a guide, any person with ordinary intelligence may maintain a healthy, pure, and genial atmosphere within his dwelling; or, using it out of doors, may ascertain the comparative salubrity of different locations, and predict changes in the weather.

The hygrodeik indicates the state of the atmosphere in relation,

1st. To its actual temperature as indicated by the ordinary thermometer (or the dry bulb thermometer of this instrument.)

2d. Sensible temperature, or the temperature due to evaporation (indicated by the wet bulb thermometer of this instrument.)

The fact that the temperature due to evaporation is often quite different (sometimes amounting to fifteen degrees), from the temperature as indicated by the thermometer, is one of very great importance, and one that is very commonly overlooked.

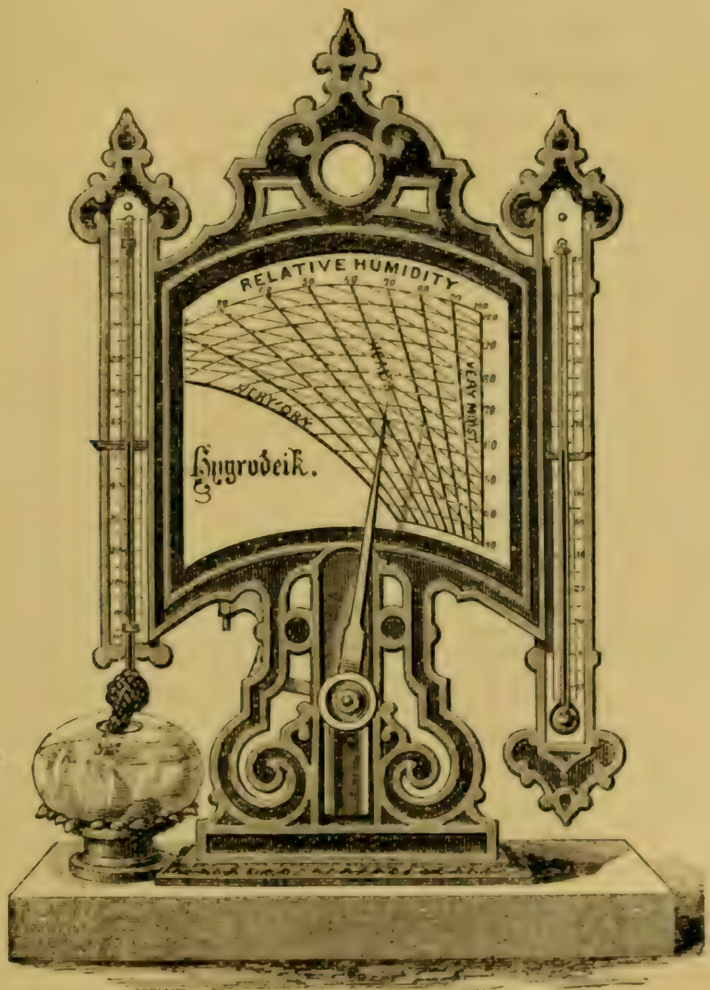
When we cover a thermometer bulb with a thin piece of cloth, and wet that cloth, we have an instrument which is sensible to the temperature of the air in precisely the same degree that our lungs are: that is, a person may feel too warm, or too cold, in a room the temperature of which (as indicated by the common thermometer) is 70 degrees; for the same reason that, in such a room, the wet bulb thermometer may indicate a temperature of 70 degrees, or of only 55 degrees; the first of which, 70 degrees, is too warm, while the latter, 55 degrees, is much too cold.

The amount of difference between the dry and wet bulb thermometers depends directly upon the amount of moisture in the air. If the air contains all the moisture that it is capable of holding, as often occurs in wash and bathing rooms, it will be found that there is no difference in the readings of the two thermometers; but if the air is very dry, as we often find it to be in artificially warmed apartments, the readings of the two thermometers may be very different.

3d. The relative amount of moisture in the air.

Air absorbes and holds in suspension watery vapor in the same manner that a sponge will hold water; but the amount that a given bulk of air will hold depends upon its temperature. Thus one cubic foot of air, at 32 degrees, will hold in suspension but two grains of water, while one cubic foot of air, at 68 degrees, will hold seven and a half grains. When air at 32 degrees has

Edson's Hygrodeik.



two grains of watery vapor in it, it is said to be saturated; if it has but half this amount, we call it half saturated. When air is saturated, that is, contains all the moisture that it is capable of holding, we say that its relative humidity is 100; if it contains three-fourths of the amount it is capable of holding, we say that its relative humidity is 75 per cent; or if one-half, 50 per cent, &c., &c.

We see from this that the relative humidity of the air does not express at all the absolute amount of watery vapor present. For instance, the relative humidity of air at zero, may be, say 90 per cent, and yet contain less watery vapor than air at 70 degrees, whose relative humidity is but 30 per cent.

4th. The dew-point.

"A glass tumbler filled with cold water, in summer, is soon bedewed with moisture, not, as is frequently imagined, because the water oozes through the tumbler, but because the air around it is cooled, and its moisture precipitated upon it. The same would occur in winter if the tumbler were brought into a close room in which many persons were assembled, and the air loaded with the accumulated vapor exhaled from their lungs and skin. From the same cause, the cold windows of a crowded lecture-room are constantly covered with minute drops of water, which soon collect together and run down the glass in streams.

The highest point of the thermometer at which vapor begins to be deposited by the air, is called the *dew-point;* it is the point at which dew begins to form."

5th. The absolute amount expressed in grains of water contained in a cubic foot of air, at the temperature, and relative humidity, as shown by the instrument.

6th. The force of vapor expressed in inches of water; in other words, the depth of water that would be deposited upon the earth by the condensation of all the vapor held in the atmosphere.

Directions for Maintaining a Healthy Atmosphere.

A full-grown person, in health, should have a supply of fresh air amounting to at least one thousand cubic feet per hour; in sickness much more is required.

To supply this amount of air to an apartment of the average size of our sitting-rooms, and under ordinary conditions, there should be an inlet and an outlet, each of an area of at least one square foot; both orifices should be so arranged as to be under perfect control, by means of blinds, registers, or valves.

Rooms warmed by furnaces, open fire-places, or by air that passes through coils of steam or hot water pipes, are usually well supplied with fresh air.

Apartments warmed by air-tight coal or wood stoves, or by steam coils and radiators, should have especial arrangements for supplying fresh air; without such special arrangements these rooms are unfit for habitation.

However large and pure the supply of air is to any apartment, and however it may be warmed, it will still be oppressive and unhealthy if moisture is not added, in proportion to the rise in temperature that the air undergoes while being conveyed from out of doors to the places where it is to be breathed.

The very importan fact that air, at a low temperature, can contain but a small amount of moisture in comparison to that it should contain if raised to a high temperature, is usually entirely overlooked; and the furnace or steam-heating apparatus is said to dry the air.

Let the air of a warm room be ever so dry, it will be found upon analysis that a cubic foot of it contains *more* moisture than a cubic foot of the out of door air, having absorbed this excess from the walls, furniture, &c. of the room.

The only remedy for a dry atmosphere is to cause vapor to be thrown into it; that is, we must have a large surface of hot water so exposed that its vapor will be taken up by the air.

The amount of vapor required depends upon the temperature of the out of door air. When the temperature of the external air is zero, about four and one-half grains of vapor must be added per cubic foot of air, to make it healthy to breathe at a temperature of 68°. When the temperature of the external air is 40°, only about two grains of vapor is required to make it healthy.

It makes no difference how the temperature is raised, moisture must be added. Nature almost invariably follows this rule; her exceptions have created the deserts of Asia and Africa.

The hygrodeik will show at a glance the amount of moisture already in the air, and also what must be added to or taken from it to render it healthy and pleasant.

Temperature.

It will be found, upon investigation, that scarcely two persons will agree upon the temperature at which the air of a room should be maintained for comfort; one will keep his room at 65°, while

another will want a temperature of 75° or even 80°; this discrepancy can be accounted for, to some extent, by the physical constitution of the individual; but the essential cause is that the common thermometer does not truly indicate the temperature which we feel, but simply the temperature of the air in which the thermometer is placed; a thermometer, to indicate sensible temperature, must have its bulb covered with a thin wet envelope. This moist covering acts for the thermometer as the skin does for the body, that is, cools it by allowing evaporation to take place.

The human body itself is very uniform in its temperature; it rarely varies two degrees either way from ninety-eight degrees; five or six degrees variation being said to be fatal.

Food, clothing, and the general temperature of our surroundings, together tend to elevate the temperature, while radiation and perspiration are the chief means by which the temperature is kept down.

Tyndall has shown by direct experiment that dry air does not check radiation, while moist does in a very marked degree; dry air tends to excessive insensible perspiration, while moist air regulates it; hence, as radiation and perspiration are cooling processes, and as both take place much more rapidly in dry than in moist air, the human body must of necessity lose heat more rapidly in dry than in moist air. It is from this cause that a person may feel comfortably warm in the moist atmosphere of a temperature which would be from 7 to 10° too cold if the same was dry.

From the above, we may infer that considerable saving in fuel may be effected by keeping the air in a healthy moist state. The mean temperature for the cold months is as follows: November, 40.40°; December, 30.58°; January, 27.03°; February, 27.61°; March, 35.52°; mean of the whole, 32.23°.

The cost of warming must depend directly upon the number of degrees through which it is necessary to raise the temperature of the air. If we permit the air of our sitting rooms to become very dry, we must maintain a temperature of say 72° to be warm, while in moist air 65° would be warm enough; in one case we warm the air 40° (from 32° to 72°), while in the other we have to warm it but 33° (from 32° to 65°); that is, make a saving in fuel in the proportion of 32 to 40, or of nearly 20 per cent.

The practical utility of the hygrodeik may be thus briefly stated:

It is a guide which, if followed, will enable us to maintain an atmosphere in inhabited rooms of such a nature—

That the most delicate lungs will not suffer from atmospheric causes; that the healthy will feel a degree of comfort never before experienced within doors; that speaking or singing becomes a pleasure; that plants may be made to bloom in it as well as in the conservatory. By following the indications of this instrument, at least twenty per cent. of fuel may be saved.

Petrified Wood.

Dr. Rowell exhibited a very fine specimen of oak wood petrified. When viewed with the microscope, it has the appearance of wood, but when broken, it has the characteristics of stone.

Dr. Feuchtwanger said he had seen many kinds of fossil wood, particularly that from Trinidad, a place well noted for many varieties of petrified wood, but in all cases the texture of the parts would indicate the character of the tree. The greatest variety of fossil wood is found in Hungary.

Ventilator.

Horton's chimney top and ventilator was next exhibited. It was so constructed that no current could pass through this ventilator from the outside. The wind blowing against it from any point of the compass is sure to create an outward or upward draft through it.

American Institute Polytechnic Association,
December 27, 1866.

Prof. S. D. Tillman in the chair; Mr. T. D. Stetson, Secretary.

The chairman opened the proceedings with the following interesting summary of scientific news:

Trees of Australia.

There are about 120 known species of forest trees in Australia. In addition to one species of Acacia, commonly known as the Blackwood, the Eucalypti embrace the most important of the native woods that are used for economical purposes in the blue gum, the red gum, the white gum, the iron bark, the box and stringy bark. These are among the largest forest trees of southeastern Australia; and in favorable situations many of them attain enormous height and girth. The blue gum often reaches to nearly 300 feet, and to 120 feet without a lateral branch. The blue gum from Tasmania s extensively used in Victoria for engineering purposes, and the stringy bark is chiefly employed for fencing. With the exception of the red gum, these trees cannot be economically used in the construction of piers and wharves, owing to the rapidity with

which they succumb to the attacks of marine animals, the Teredo and the Chelura. The Swan River Mahogany, a species of Eucalyptus, is the only wood yet used there which entirely resists these agencies. There are no pines in Australia. Pine for inside work of houses is mostly imported from America.

Australian Barks.

The barks of many varieties of trees are remarkable for their astringent qualities, and contain a large percentage of tannin. Those used in the manufacture of leather are from various Wattle trees belonging to the Acacia family. They impart to the leather a reddish brown color, darker than American oak-tanned, and more nearly resembling that produced by the American hemlock.

Australian Essential Oils.

J. W. Osborne, Esq., formerly of Australia, states that leaves from which essential oils can be extracted, constitute the great bulk of the forest vegetation. The yield of Dandenong (Eucalyptus Amygdalina) is astonishingly plentiful—130 pounds of freshly gathered leaves, including small branchlets, to which they are attached, give upward of three pints. The oil exists ready formed in the leaf, and the cells containing it may be seen in great numbers on examination by transmitted light. The oil is a thin, transparent fluid, of pale yellow color, having a pungent odor, resembling that of oil of lemons, but coarser and stronger; its taste is rather mild and cooling, producing an after sensation in the mouth, resembling camphor, with something of its bitterness. Its specific gravity at 60° F. is 0.881. The boiling point is 330. It is somewhat less volatile than turpentine. Like other essential oils, it leaves no stain on paper, and in shallow vessels it absorbs oxygen, giving rise to a residual resinous matter. When brought in contact with iodine, no explosion ensues, even when the temperature is raised, but a dark colored solution is created, which, when heated, emits a peculiarly variegated vapor, in which the colors, yellow, red, violet, green and blue are beautifully visible, particularly in sunlight.

This oil is soluble in all proportions in turpentine, both fat and drying oil, benzine, naptha, ether, chloroform and absolute alcohol. Its power for dissolving resinous substances may be estimated by the following: In one pint of the oil are solable 23.3 av. ounces of camphor, or 20.3 ounces of rosin, or 17.5 of mastic,

or 7.3 ounces of gum Damara, or 1.94 of copal, or 1.16 of shellac, or .73 of caoutchouc, while gutta percha digested in it for several days was not sensibly affected. This oil may be considered the type of about 20 oils from Australian leaves, which are suitable for general application in the arts.

Creosote.

Dr. A. E. Hoffman, after experimenting with a compound which he purchased under the name of beechwood tar, decided that creosote was impure carbolic (phenic) acid. Van Gorup Basanez disputes this, and says that beechwood tar creosote has long since disappeared from German commerce. It is well known that phenic acid is sometimes sold for creosote. Both have antiseptic properties.

Hydrated Peroxide of Copper.

C. Wetzein, in a note to the French Academy, says when peroxide of hydrogen is added to a solution of ammonia, sulphate of copper, there is a lively disengagement of oxygen, and an olive-green precipitate is produced, which is doubtless identical with the peroxide of copper obtained by Thenard and Boettger. The author describes several of its reactions.

Glyconine.

E. Sichel has formed a new glycerole by mixing four parts of yolk of eggs and five parts of pure glycerine in a mortar. The mass has the consistency of honey, and is unctuous, like fat bodies. It was unaltered by an exposure to the air for three years. Applied to the skin, it forms a varnish impervious to the air.

Sorghum.

Henry Erni, chemist in the Department of Agriculture, has analyzed two new varieties of Chinese sugar cane, marked 3 and 4. One hundred parts of No. 3 contained 4.38 parts of uncrystallizable sugar, and 7.86 parts of cane sugar, the total of the two sugars being 12.24 ; specific gravity of the juice, 1.083. One hundred parts of No. 4 yielded 3.60 parts of uncrystallizable sugar, and 5.94 parts of cane sugar—total of the two sugars, 9.54 ; specific gravity of the juice, 1.075.

An important matter to the farmer, under the existing internal revenue laws, is the sale of sorghum molasses to the vinegar manufacturer. One barrel of thick molasses, diluted with water until

the seccharometer indicates 10 per cent., will probably yield six barrels of sugary liquid, which, after complete fermentation with beer yeast (75 to 90 deg. Fahr.), may be poured at once upon the vinegar generators, and will yield a vinegar containing a little less than seven per cent., by weight, of hydrated acetic acid, and fully strong enough for household purposes.

New Formula for Silvering Paper.

At the November meeting of the American Photographical Society, the following new formula for composition of the silver bath, by Henry J. Newton, of New York, was presented: water, one ounce; nitrate of silver, twenty-five grains; nitrate of magnesium, twenty-five grains; nitrate of potassium, twenty-five grains; acetate of lead, five grains. Let the solution stand for several hours in the sun; filter, then float the paper about three minutes, and tone as usual. The formula was commended by practical photographers who had experimented with it.

Prof. S. D. Tillman remarked, viewing the compound from a theoretic standpoint, he should at once decide that the magnesium salt was a beneficial ingredient in this mixture, and one likely to lessen the amount of silver essential to the operation of preparing the paper. Magnesium, although a biatonic metal, forms haloid compounds, often found associated with the alkaline haloids. Magnesium, in the process of combustion forming magnesia, generates the complete series of waves which produce white light. We know the actinic waves are present from the fact that this light will cause a mechanical mixture of chlorine and hydrogen (inert in the dark or under the yellow ray) to instantaneously combine chemically and form hydrochloric acid gas. The atomic weight of magnesium is double that of carbon, and as a multiple of the latter may be classed with silver.

The remarkable sensitiveness of nitrate of silver, under the action of light, and the almost instantaneous distraction of color in certain substances with which it combines, probably results from the neutralizing effect of one portion of its components upon another. They have peculiar numerical relations, which may be expressed in the old notation, thus : $(N\ O_5) \times Ag \times O$, in which the combining weight of the first term (54) is just one-half that of the second term (108). The absence of color or the entire absorption of light may result from the interference of two series of waves, rendered similar by action of the compound, which is aptly illus-

trated by two similar series of air-waves; producing separately two sounds; but when brought in opposition to each other, they are completely neutralized, silence being the result.

In every photographic process used thus far, the action of silver is the *sine qua non*, although a very small proportion of the whole amount employed becomes a part of the picture. Hence it is an interesting problem to determine, by the use of other salts, the least quantity of silver required to produce the desired result.

White Lead and Saltpeter.

Clarence Delafield, of Staten Island, has patented a process for manufacturing carbonate of lead. He claims his product is whiter and purer than can be produced by the old Dutch process. It consists in mixing a hot solution of nitrate of lead with a hot solution of carbonate of potash, and passing into the mixture superheated steam, which, it is claimed, prevents the formation of hydrated oxyd of lead, and by his peculiar manipulation the whole is changed to carbonate of lead. After the salts of lead have been precipitated, the remaining solution of nitrate of potash is drawn off and evaporated, thus leaving very pure crystals of saltpeter.

On Blue Slags.

C. Méne, in a paper read before the French Academy, stated that the presence of titanic acid is not always the cause of the blue color in slags, as is generally supposed. From nineteen analyses he concluded this acid was the coloring matter in vitreous but not in compact slag. M. Cheureul remarked, after the reading of this paper, that the blue coloration might sometimes be due to the presence of particular oxyd of iron.

Deterioration of Bituminous Coal.

Herr Grundmann, of Farnowitz, in Germany, and Herr Varentrapp, have recently made experiments which prove conclusively that soft coal—both that used for cooking and for gas—is slowly oxydized at ordinary temperatures. The conclusions of the latter are briefly stated by Prof. Rockwell, in *The American Journal of Mining*, as follows: That during the period of exposure the coal underwent a process of slow combustion, taking up oxygen and giving off the volatile products of oxydation. In this decomposition, air and moisture play the principal part, and warmth is the condition of promoting it. The degree of heat determines the

rapidity of the process. The heat may be sufficient to ignite the inflammable gases, as is not unfrequently shown by the spontaneous combustion of large heaps of coal, and by the fires in the mines themselves; that the decomposition was the same in the interior of the heaps as on the surface, it being equally rapid at both points; that the action was most rapid during the first few weeks of exposure, the heat generated by decomposition reaching its maximum about the third or fourth week; that one-half the oxygen absorbed was taken up during the first fourteen days. The well known fact that coal long mined is far less liable to spontaneous combustion may be adduced as corroborative evidence of this. That a coal originally poor in oxygen, decomposes more rapidly than one rich in it. That coal, dried at a temperature of 212° Fahrenheit till its weight remains constant, can be heated up to 392° Fahrenheit (200° C.) without further loss of weight. Hence, water is an active element in the decomposition. That large coal, exposing less surface to the action of the air and moisture than small coal, is much less rapidly decomposed. The tendency, however, of large lumps, having joints, to fall to pieces on exposure is well known.

The analysis of freshly mined coal of several heaps gave the following composition:

	I.	II.	III.
Carbon	71.51 per cent.	78.32 per cent.	82.21 per cent.
Hydrogen	5.32 per cent.	5.04 per cent.	5.38 per cent.
Nitrogen	0.92 per cent.	0.88 per cent.	0.89 per cent.
Oxygen	5.83 per cent.	8.08 per cent.	5.72 per cent.
Sulphur	1.08 per cent.	0.66 per cent.	0.77 per cent.
Ash	10.34 per cent.	7.02 per cent.	6.03 per cent.
Total	100.	100.	100.

The result of the experiment is as follows:

Small Coal in Heaps.

	I.	II.	III.
Absolute loss of weight	33.08 per cent.	44.61 per cent.	42.19 per cent.
Loss of value as fuel	47.60 per cent.	56.81 per cent.	55.38 per cent.
Loss of value as gas	45.51 per cent.	47.95 per cent.	50.29 per cent.

Large Coal kept Under Cover.

	I.	II.	III.
Absolute loss of weight	10.69 per cent.	6.36 per cent.	3.19 per cent.
Loss of value as fuel	12.59 per cent.	9.04 per cent.	4.66 per cent.
Loss of value as gas	23.93 per cent.	16.32 per cent.	14.24 per cent.

The great mass of coal consumed in this part of our country being anthracite, the majority of consumers are not directly inter-

ested in the facts now presented. However, it behoves all bituminous coal miners and dealers, and more especially coal-gas companies to protect, as far as possible, their coal from exposure, and never to gather it in large heaps while it is wet.

Action of Light on Iodine of Silver.

At the November meeting of the American Photographical Society, Professor S. D. Tillman remarked that the subiodide of silver is not necessarily formed by the action of light on the iodine. M. Carey Lea, in an able paper, to be found in the September number of *Silliman's Journal*, "on the nature of the action of light upon iodide of silver," has very clearly shown that pure isolated iodide of silver undergoes no reduction when exposed to light many thousand times longer than it usually is in the photographic process. The original amount of silver and of iodine remains after such exposure. Hence, he concludes there is no chemical action. What the nature of the change is we do not yet comprehend. It may be that a new class of metamers are formed, which are not to be distinguished by different atomic arrangement. We can conceive that the atom may undergo a metamorphism as the result of a modification of its normal motion, and on the withdrawal of the exciting cause, it may resume its original condition. There is a large class of metallic salts which, at a low temperature, absorb from the air an atom of oxygen, and at a higher temperature, part with it. Alternating action may be thus continued for any length of time by a change of temperature. This is a true chemical action. In the case of the effect of light upon the silver haloid, the action may be chemical, although there may be no change in the amount of material.

We assume in cases of isomerism that there is a change in the arrangement of atoms. For instance, we give to every one of the nine isomers of Rutic acid a different formula, while, in fact, each consists of ten atoms of carbon, twenty of hydrogen, and two of oxygen, according to the new notation. It cannot be proved that these different arrangements of atoms actually exit; yet these formulæ materially assist us in conceiving how different chemical functions may belong to bodies of the same ultimate composition.

Again, we may suppose such chemical action takes place as to produce homologues, which are simple multiples of the atom of iodide of silver. Light not only decomposes carbonic anhydride, by means of the leaf, but it probably so modifies the atoms of

carbon and hydrogen that they form the homologous hydrocarbons, which can be obtained from wood by distillation. Light, in the case of iodide of silver, may have the power of doubling the number of elemental atoms in a compound atom, and as the number of such compound atoms is only half of that of the original compound atom, the total amount of iodine and silver in such a body would remain the same.

The remarkable action of silver haloids may depend somewhat on their *typical* equivalence, and still more on the numerical relations of their atomic weights. Silver is the only common metal regarded as mon-atomic. In this respect it resembles the four halogens, and differs from all the metals except those of the alkaline class. The atomic weight of silver is equal to the difference between that of the lightest and heaviest halogen. Both the element, iodine and the salt, fluoride of silver, are on the hydrogen scale, respresented by the number 127.

Looking in another direction, we notice that an atom of silver weighs just nine times as much as one of carbon, which is classed among the tetratomic elements. Numerous compounds containing carbon and chlorine are wonderfully sensitive to light; and, it may not be too presumptuous here to predict, that among them may hereafter be found, a substitute for the silver salt.

Collossal Laboratories.

The Prussian government, fully aware of the great national importance of chemistry, has given orders that two immense chemical laboratories shall be erected, one at Berlin, and the other at Bonn, under the direction of Professor A. W. Hoffmann, the distinguished chemist and author, who has until lately resided and lectured in London. The building and court at Bonn occupies about 44,000 square feet. It adjoins the Botanical Garden, and is near the University. The basement contains, besides store rooms, the rooms for metallurgical and other operations requiring large quantities of fuel, those for medico-legal and chemico-physiological research, &c. All the remaining spaces intended for educational purposes, viz: the laboratories with their adjoining rooms for especial operations, and side-rooms, balance-rooms, rooms for volumetric analysis, combustion rooms, lecture theaters, museums of specimens, the study and private laboratory of the director and the apartments of assistants are, one and all, on the ground floor.

Mr. Joseph S. Wood read the following interesting paper on

The Internal Heat of the Earth.

Many carefully made observations have determined the fact, that the temperature of the earth increases at the rate of 1° C. for a depth of 30 metres, or 98½ feet. Supposing this rate constant, the temperature of the earth, at a depth of 60,000 metres, or 37 miles, must be 2,000° C. As no substance is known to exist as a solid at this temperature, the conclusion follows that the crust of the globe is 37 miles thick, and the rest, beyond that depth, a molten mass.

To account for this condition of the earth, La Place advanced the theory, that our solar system was a very thinly attenuated mass of nebulous matter, which, by a rotatory motion, was drawn together in globular liquid masses; that these bodies have ever since been and are now cooling, our earth having cooled sufficiently to form the solid crust on which we live.

Upon this hypothesis are explained volcanic eruptions, earthquakes, geysers, hot springs, the oblation of the earth at its poles, the igneous formation of plutonic rocks, and the torrid climate formerly existing in some portions of the Arctic zone.

Notwithstanding its plausibility and simplicity, very grave objections have been raised against it; and Lyell, together with others, evidently accepts it simply from want of a better.

If our solar system was created by the contraction of a nebulous mass, an immense amount of heat must have been radiated therefrom.

As force cannot exist independently of matter, the question arises, by what bodies was this heat absorbed? As the stars and nebulæ, the only bodies outside of our solar system known to exist, are sources of heat themselves, they evidently cannot be the absorbents.

If all the bodies of our solar system were once masses of molten matter, they must have radiated a portion of their heat in obtaining solid surfaces; but not to one another, since, however, unequally heated they may have been, they could not radiate heat to each other, all being molten, so that the surfaces of all should solidify.

If the earth is radiating heat, it must be contracting; but La Place has shown that no contraction has taken place for at least 2,500 years.

Mayer, in his Celestial Dynamics, asserts that if the earth's interior is a molten cooling mass, it must, like all such bodies, be

of the same temperature throughout, the equability being maintained by the process of convection; and Lyell not only makes the same assertion, but declares that if the earth ever was an entirely molten mass, this process of convection must have prevented the solidification of any portion of the globe, until the whole was of the temperature at which it solidifies; and that the solidification would begin at the centre, not at the surface, so that the latter could not solidify till all the rest had.

If, as recent experiments render probable, all bodies attain their maximum liquid density at a temperature, which is a few degrees above that at which they solidify, the formation of a solid crust while the interior remained molten would have been possible, after the manner in which ice is formed on the surface of water; but as in all such cases, the temperature of the whole mass must be that of its maximum liquid density before the first film of a solid surface can be formed.

At temperatures between that of the maximum liquid density and of solidification all bodies expand; but as soon as any portion solidifies, it, if still cooling, contracts. If this cooling is continued long enough, the solid will soon attain a density equal to, and then greater than that of the liquid mass, and will sink.

Hence the existence of a solid crust or surface produced from and upon a liquid mass by cooling, is only possible when the cooling is not continued, till that solid surface attains a greater specific gravity than the underlying liquid mass. As this condition is not fulfilled in the earth's case, the conclusion follows, that its solid surface never was formed by the cooling of a liquid body.

The fact that some portions of the earth in the Arctic and Temperate zones have once possessed a much warmer climate than now, is proved beyond doubt by their fossil remains, and seems to afford a strong point in favor of La Place's theory; but geological investigations have shown that some portions of the earth, especially during the glacial epoch, possessed a much colder climate than now.

If the fact that some parts of the earth are colder now than they have been, is explained upon the theory that the earth is cooling; how can the fact that some portions of the earth are warmer now than formerly, be gotten over?

On the other hand, Lyell shows very beautifully, how the gradual upheaval and depression of the land could have produced, and is producing, very great changes in climate, making some portions of the earth cooler and others warmer. Hence the changes in climate which have taken place in some portions of the earth, are no proof that the earth is a cooling body.

That the phenomena of earthquakes, volcanic eruptions, geysers and hot springs, are local, observation has conclusively shown. That they cannot be attributed to a molten mass underlying the whole surface of the earth, is almost a necessary conclusion therefrom.

Lyell believes, that the substances emitted from volcanoes, geysers and hot spings, exist in large subterranean masses, and that earthquakes are caused by their movements.

Many districts, such as southern France, are filled with extinct volcanoes. If the earth's interior is a molten mass, from which the substances emitted from volcanoes are drawn, why has any volcano ever become extinct? Upon Lyell's theory, the explanation is, that the sea or lake from which they were supplied, has been exhausted.

The idea that granite and other plutonic rocks are the oldest geological formations, and were therefore the first solid surface of the earth, is a strong support to La Place's theory, but Hutton and Lyell have shown that these rocks vary in age, and are in many cases of a much later formation than the rocks and strata underlying them. They have shown that these rocks, like all others, are continually forming, and are in all probability never produced except under, and, therefore, after, the formation of overlying strata; since wherever plutonic rocks are found, the adjoining and overlying strata are greatly disturbed; some are converted into metamorphic rocks, and in many cases veins and runners are found projecting from the mass of the rock into the surrounding strata.

The cause of earthquakes, volcanic eruptions, geysers, and the formation of plutonic rocks, cannot be given until sufficient data have been obtained for its explanation. Simply as an hypothesis submitted to the test of observation, I suggest that the depression which certain districts of the earth is undergoing is the cause of these movements; that not only are volcanic eruptions and the formation of plutonic rocks due to the same cause and the same masses of liquid matter, but that when plutonic rocks are formed

without an accompanying volcanic eruption, the movement is the same as when with; the upward pressure being sufficient in the latter case to find a vent and in the former not, and that those earthquakes which are unaccompanied with volcanic eruption, are probably produced by the same movement.

The similarity between lavas and plutonic rocks in chemical composition, is a very strong indication of their production from the same masses of matter; and the difference in their specific gravities is explained by the fact, that the lavas cool quickly under the pressure of the atmosphere only, while the plutonic rocks cool slowly under the pressure of overlying strata.

Since, according to this hypothesis, plutonic rocks are only formed under the pressure of overlying strata, their exposure on the surface is always due, either to a second push from beneath, or to denudation.

Whether the subterranean masses upon which these phenomena depend will become exhausted, or whether new masses of molten matter are forming, are questions which cannot now be answered.

If the depressions of some portions of the earth is squeezing out these lakes or seas, the upheaval of other districts may be producing them, and thus when in course of time the district now upheaving will be depressed, it will in time become volcanic.

What causes the upheaval and depression of the earth's surface, and how far down these movements extend, are questions of great importance. Since the daily revolution of the earth on its axis leads to the movement of the tides, and its annual revolution round the sun changes the movement of the ocean currents, may not its movement with the whole solar system round a central orb produce this upheaval and depression?

The oblation of the earth at its poles has very inconsiderately been offered as a proof that the earth was once a liquid mass. Why must we first melt the earth to flatten it at its poles? Why not suppose it once a cylinder instead of a sphere, which rotation made an oblate spheroid?

As Lyell well remarks, the earth has, as long as we have known anything about it, had the same flattening at its poles it has now. Why has it not always, and without of necessity ever having been liquid? In fact, the only form in which a revolving body, solid or liquid, can exist in a state of stable equilibrium, is that of an oblate spheroid.

To recapitulate: 1st. The solar system has never been a nebu-

lous mass. 2d. The earth has never existed without a solid surface. 3d. It isn't cooling, since it isn't contracting. 4th. The changes in climate of different portions of the earth are due to the upheaval and depression of the land. 5th. That Plutonic rocks are not the oldest geological formations, and were not, therefore, the first solid crust of our globe. 6th. That earthquakes, volcanic eruptions, geysers, hot springs and Plutonic rocks are produced from internal seas or lakes of the substances wherewith they are composed; that the movements of the latter are probably caused by the gradual depression of the districts wherein they are located; and their formation, possibly, by the gradual upheaval of others. 7th. That the earth always has been an oblate spheroid.

The increased temperature of the earth, as we descend into its depths, is the only fact not yet considered. Its truth is unquestionable, but the deduction therefrom, that beyond a given depth the earth must be a liquid mass, is fallacious; the fallacy lies in the assumption, that an increase of temperature necessarily produces expansion.

A substance can be heated in two ways, either under a constant pressure, or a constant volume. When heated under a constant volume, an increased pressure must be created for every increase of temperature; and *vice versa*, a body will exist at a constant volume, or in other words will not expand, although different parts are of different temperatures, provided the pressures upon these different parts correspond with their temperatures.

I have no doubt that there are masses in the earth whose temperature is so great that they, *under the pressure of the atmosphere only*, would flash into vapor; but under the pressure of miles on miles of earth above them, are as solid as the surface on which we tread.

The relationship between temperature and pressure cannot be too forcibly urged. Water will boil under the pressure of the atmosphere at 100° C.; but under a pressure of atmospheres at $100 \times {}_{n}$ °C. So the substances composing the earth would all melt at temperatures less than 2,000° C., under the pressure of the atmosphere, but not by any means under ten times that pressure.

Whether the earth is entirely solid, the sources of volcanoes, &c., excepted, is a question whose answer depends on the relative increase of the temperature and pressure in the earth's interior. If the two correspond, then the earth is solid.

Since the internal heat of the earth is not caused by the cooling

of a molten mass, the question naturally arises, by what is it produced? I answer, gravity.

The idea that force must produce motion, is a mistaken one. Force is what produces or *tends* to produce motion. Hence it exists in two states or conditions, one of action, and the other of tension; when in the former it it is dynamical, in the latter, kinetic or statical.

As a force is only dynamical when transferring from one body to another the means by which the transfer is made, being motion, the dynamical is merely a temporary condition of force, the kinetic, permanent.

As I hold this book in my hand, it is acted on by a force which tends to draw it towards the earth's centre of gravity. I let it fall; while falling, the force of gravity is dynamical; while at rest, it is kinetic.

Again, all forces can be divided into two great classes; forces of attraction and of repulsion, the sum of each being equal. Any force can be converted into any other of the same kind, but not into one of the other. Gravity is a force of attraction; heat, of repulsion. One cannot exist without the other; they are, like all other forces, necessary attributes of matter, and are also correlative and antithetical to each other. When gravity is dynamical, or in other words, is transferring itself from one body to another, an equal amount of heat is set free. When gravity is kinetic, an equal amount of heat is also kinetic.

Thus the force of attraction acting on this book may be represented by a line drawn from it to the earth's centre of gravity; the amount of heat also acting on it must likewise be represented by the same line, both at present being kinetic. I drop the book, and a certain portion of the gravity, represented by the distance through which it falls, is set free or becomes dynamical, and so does an equal amount of heat.

To answer the questions, "What has become of the gravity set free?" and "since the force of gravity varies inversely as the square of the distance, is it not greater after than before the book fell?" an explanation of a theory advanced by Helmholtz, and indorsed by Faraday, is necessary. "The *intensity* of the force of gravity varies inversely as the square of the distance, but not the amount of force. A force is measured by the distance it can move a given body." Before this book was dropped, the force of gravity tended to move it through a greater distance than now;

hence the book is now acted on by a smaller force of gravity than before it fell.

The greater the distance between two bodies the greater the kinetic forces acting on them. Herein lies the answer to the question, what becomes of the gravity set free from the book? The answer is, it is transferred to the atoms or molecules of surrounding bodies, and converted into the force of cohesion.

When the book fell, not only was heat transferred to the surrounding matter, but the atoms of the latter were separated from each other by expansion. Indeed the fact that heat produces expansion, proves that an increase of heat must be accompanied with an increase of attractive force.

The force of cohesion acts upon the atoms or molecules of all substances, tending to draw them together, and the force of gravity acts upon all the heavenly bodies in the same way. Since they are not drawn together, they must be kept apart by a force of repulsion, exactly equal to the force of attraction. Since, when the atoms of a body are drawn together, heat is set free; the conclusion follows, that it must have been previously existing in the body, in a kinetic state; and since an equal amount of the force of cohesion is also let loose, the heat and the cohesive force must have been holding each other *in equilibrio*. Indeed no force can be kinetic, unless held *in equilibrio* by another; and the true cause why the earth is not drawn into the sun, as well as why two molecules do not touch, is not the centrifugal force, but the force of heat.

As a test of this theory that the internal heat of the earth is caused by gravity, I proposed, in a draft of this paper, written in January, 1865, the following: If the earth's interior is a molten mass, the waters of the ocean should be undergoing a process of convection similar to that of the water in a tea kettle over a fire; and the temperature of the whole should be the same for all depths. If, on the other hand, it is caused by gravity, then no process of convection should be going on; and the temperature should increase with the depth. Since that time I have met with the following paragraph in Mayer's Celestial Dynamics: "Franklin observed in lat. 77° N., long. 12° E., that the temperature of the sea near the surface was —½°, and at the depth of 700 fathoms 6°. Fisher in lat. 80° N., long. 11° E., noticed that the surface

water had a temperature of 0°, while at the depth of 140 fathoms it stood at 8°.

* * * * * * * * *

The some phenomenon has been observed in other parts of the world, such as the west coast of Australia, the Adriatic, the Lago Maggiore, &c. Especial mention should be made of an observation by Horner, according to whom the lead when hauled up from a depth varying from 80 to 100 fathoms in the mighty gulf stream off the coast of America, used to be hotter than boiling water."

The same test is applicable to the atmosphere. If the earth is a cooling body, a process of convection such as the sun daily causes, should be continually going on, and the temperature of the whole should be the same; but if an increase in pressure produces an increase in temperature, the cooling of the air as we ascend from the earth, is at once evident.

If this theory is true, two columns equal in length, of substances whose specific gravities are different, would not produce an equal increase cf temperature. As the rocks and strata in some portions of the earth are heavier than in others, the rate of increase in temperature should be different in different parts of the world. This assertion is abundantly verified by observation, but as no data have been given of the specific gravities of the substances, whose rates of increase have been ascertained, this point must be left open for investigation.

If the ideas advanced herein are sound, a satisfactory solution of the vexed question, "what is the cause of the sun's heat ?" is obtained; for, if the molecules of our earth can generate a temperature of 212,754° C. at their centre of gravity, the bodies of our solar system must produce at least the temperature of the sun at theirs.

In conclusion, I believe that the earth is a solid body; that its internal heat and the heat of the sun are caused by gravity; that force is a necessary attribute of matter; that the sum of all the forces of attraction in the universe is exactly equal to the sum of all those of repulsion; that heat and gravity are equal and antithetical; that no force can be kinetic unless held *in equilibrio* by one or more of the opposite kind; and that the atoms or molecules of matter, and the bodies of our solar system and the universe, are apart and together on account of this antagonism.

This paper gave rise to some discussion, after which the association adjourned.

American Institute Polytechnic Association,
January 4, 1867.

Prof. S. D. Tillman, Chairman; T. D. Stetson, Esq., Sec'y.

The Chairman presented the following scientific summary:

Functions of Leaves.

M. Boussingault, in a paper read at the French Academy of Sciences, states experiments made by him show that the under-surface of the leaf decomposes considerably more carbonic acid than the upper-surface, even when exposed to the direct action of the sun's rays. In some instances he found the difference was as 4 to 1.

Aluminium and Calcium.

Wöhler has recently succeeded in preparing an alloy of these metals, by heating aluminium and sodium with a large excess of chloride of calcium. The alloy is very lustrous, of a lead gray color, and not tarnishable by either air or water. Its specific gravity is 2.57, or slightly more than that of hammered aluminium.

Aluminium and magnesium.

Wöhler has made an alloy of these metals, by fusing equal combining proportions or equivalents under a layer of common salt. The alloy has the color of tin, and is very brittle. At a red heat it combines with the oxygen of the air, and produces a flame almost as brilliant as that of pure magnesium.

Organic Remains.

The polishing slate found in Bohemia has been computed to contain, in every cubic inch, forty-one thousand millions of infusoria. Since a cubic inch of this slate weighs 220 grains, in every single grain there are one hundred and eighty-seven millions of skeletons of silesious shields. This mineral, which may literally be called the *grave stone* of extinct organisms, contains many millions more remains of microscopic animals than are found in the same weight of chalk.

Meteorology in America.

The Chamber of Commerce of New York has now in operation at its rooms, Hough's wonderfnl self-recording barometer, which, by means of electricity, notes any change in the column exceeding one-thousandth of an inch, and, by the intervention of clock-work,

prints these changes at stated intervals, at the same time describing the curve of variation. At the end of every twenty-four hours a leaf of figures and diagrams is completed, which forms a part of the annual volume of automatic records.

The Silvered Object-Glass.

M. Leverrier informs the French Academy that M. Foucault's process for weakening the solar radiation by covering the object-glass with a film of silver, has been successfully applied to a glass twenty-five centimeters in diameter. The interposition of the film of silver does not appear to materially alter its optical qualities. The spectroscope shows that all the rays of the spectrum are present except the extreme red—the orange yellow and green undergoing partial extinction. Under favorable conditions of the atmosphere, a power of 300 diameters could be applied, and the entire surface of the sun was seen to be covered with those numerous details known to experienced observers. The transmitted light is blueish, to which the eye soon becomes accustomed.

Meteorological Observations in Great Britain.

The Board of Trade, upon the recommendation of the Royal Society, has followed the example set by the Imperial Observatory of Paris, and ordered the Observatory at Kew to be enlarged and made the Central Observatory station, which is to be in connection with subordinate stations at Falmouth, Stonyhurst, Armagh, Glasgow and Aberdeen. Each of the stations is to be provided with self-recording instruments. Observations are also to be taken at sixty other stations, lighthouses &c. Outline maps will be published every day, showing the direction of the wind at each station. *Forecasts* are to be discontinued as untrustworthy, while the *storm-warnings* are to be kept up; but the Board requires that the officer who hoists the signals shall note down at the time all the reasons which guided him in making the prediction.

Modes of Crystalizing.

M. E. Fremy, in a communication to the French Academy, describes various methods for slowly precipitating certain chemical compounds which are amorphous owing to the suddenness of their formation, thus enabling him to obtain them in a chrystaline form. In some cases the bodies to be decomposed were introduced into liquids of different density, containing gum, sugar,

gelatine, &c.; in others they were placed in vessels of wood or unglazed porcelain. He also had recourse to the Osmose process. Thus he succeeded in obtaining chrystals of sulphate of baryta, carbonate of lead, sulphate of strontia, carbonate of baryta, borate of baryta, chromate of baryta, oxalate of lime, magnesia, and several sulphides. He did not, however, succeed in obtaining pure quartz by the reaction of alkaline silicates on certain acids.

Spectral Lines.

Prof. Hinricks, of Iowa State University, communicates to *The American Journal of Science* his latest deductions founded on the revelations of the spectroscope. Adopting the determinations of Plücker and Ditscheiner of the wave-length of a great number of the lines laid down in Kirchoff's map of the spectrum, by a simple geometrical interpolation, he is enabled to find the wave-length of any of Kirchoff's lines, with great accuracy. The scale he used made the length of the spectrum from B to G nearly 15 feet; in some instances he used a scale 5 times longer, making the spectrum 75 feet. The examination of the determinations for 13 of the chemical elements and four compounds, shows that the dark lines of the elements are equidistant throughout the spectrum, but of varying intensity, many not being observed (or observable) at all; and Hinricks further finds that the intervals between the observable lines are expressible as simple multiples of the equal distances indicated by all.

Steam Power on Canals.

Steam power has been applied on a canal in Ireland 160 miles long, having only 30 feet of navigable width, and a depth of 5 feet 2 inches. Its locks are only 60 feet long, by 13½ wide. One steamer, propelled by a screw, drew three boats, each containing 40 tons of cargo, at about 2½ miles per hour. On a long level of 25½ miles, two steamers performed the work so well that horses have been withdrawn from that portion of the canal. The screw which had been proved to be the best had a width of blade at the circumference of 32 inches cut away at the base to the extent that was consistent with strength; its pitch was an increasing one, varying from 5 feet 3 inches to 7 feet 9 inches.

On the Erie canal—navigated by boats, each carrying on the average more than five times the load of a boat on the Irish

canal—numerous experiments have been tried with steam, none of which can be regarded as entirely successful.

On the river Oise, in France, boats have lately been drawn by means of a steam-carriage on the towing-path, which readily moves up the steep grade at each lock.

Indium.

This rare metal was first discovered about three years ago by Messrs Richter and Rich, of the Erieburg Mining Academy, in the zinc blende, in the vicinity of Frieburg. It has lately been found by M. M. Kachler and Schrötter, in the blende at Schönfeld, near Schlagenw. M. Winckler considers it best, in extracting indium, to treat the roasted blende by hydrochloric acid, to precipitate by an excess of zinc the indium, copper, lead, cadnium, &c., and to separate these metals by sulphuretted hydrogen and carbonate of baryta. M. Schrötter modifies the method by treating the blende, after roasting, with sulphuric instead of hydrochloric acid, precipitating the indium by zinc and fractioning the precipitates ; the purification of indium is then easier in consequence of this division. Indium may be ranked among the heavier metals ; its specific gravity being from 7.11 in the granular state to 7.28 after hammering. Its color resembles that of platinum. Its luster is not tarnished by exposure to air or even boiling water. It is softer and more malleable than lead, and is as volatile as magnesium or zinc. It forms but one oxide. Its salts are colorless, but when exposed to the flame of a Bunsen burner, impart to it a blue or violet tinge. In its electric properties indium resembles cadmium, but is more electro-negative.

Food Required for Internal Work.

Professor Frankland publishes the following statement, which contains the weight of various articles of food required to sustain respiration and circulation in the body of an average man during twenty-four hours :

Name of Food.	Weight in oz.
Cod liver oil	1.5
Butter	1.8
Cocoa-nibs	1.9
Cheshire cheese	3.0
Oatmeal	3.4
Arrowroot	3.4
Flour	3.5
Pea-meal	3.5
Gelatine	3.6

Name of Food.	Weight in oz.
Ground rice	3.6
Lump sugar	3.9
Grape sugar	4.
Hard-boiled egg	5.8
Bread	6-4
Lean ham	7.9
Mackerel	8.3
Lean beef	9.3
Lean veal	11.4
Potatoes	13.4
Apples	20.7
Milk	21.2
White of egg	23.1
Carrots	25.6
Cabbage	31.6

It should be borne in every mind that the kind and quality of food required for repairing and enlarging the human body does not enter into this calculation.

Force—Value of Food.

The following table contains most of the determinations of Professor Frankland on the weight and cost of various articles of food required to be oxydized in the body, in order to raise one hundred and forty pounds to the hight of 10,000 feet; the external work being equal to one-fifth of the actual energy. They are here arranged to show the relative force-valve. The cost is given at London prices. The relative cheapness in any other locality will be easily estimated by substituting its market prices for those of London. It is to be regretted that no experiments were made with mutton and mutton-fat:

Name of food.	Weight in lb. required.	Price per lb. s.	Price per lb. d.	Cost. s.	Cost. d.
Cod liver oil	0.553	3	6	1	11¼
Beef-fat	0.555		10		5½
Butter	0.693	1	6	1	0¼
Cocoa-nibs	0.735	1	6	1	0½
Cheshire cheese	1.156		10		11½
Oatmeal	1.281		2¾		3½
Arrowroot	1.287	1	0	1	3½
Flour	1.311		2¾		3¾
Pea-meal	1.335		3¼		4½
Ground rice	1.341		4		5½
Isinglass	1.377	16	0	22	0½
Lump sugar	1.505		6	1	3
Grape sugar	1.537		3½		5½
Hard-boiled egg	2.209		6½	1	2½

Name of food.	Weight in lb.	Price per lb.	Cost.
Bread	2.345	2	4¾
Lean ham, boiled	3.001	1 6	4 6
Mackerel	3.124	8	2 1
Lean beef	3.522	1 0	3 6½
Lean veal	4.300	1 0	4 3½
Potatoes	5.068	1	5½
Milk	8.021	(5d. per quart.)	1 3½
White of egg	8.745	6	4 4½
Carrots	9.685	1½	1 2½
Cabbage	12.020	1	1 0¼
Pale ale, bottled	9 bottles,	10	7 6

At London, the relative cheapness of the principal artices of food, is represented by the following order, viz : Oatmeal, flour, pea-meal, bread, potatoes, ground rice, beef-fat, grape sugar, cabbage, cheese, butter, eggs, carrots, cane sugar, milk, mackerel, beef, veal, and lastly, pale ale, which, as a motor, costs twenty-four times more than flour.

Source of Muscular Power.

Liebig and his disciples have held that, while animal *heat* is the result of oxydation of food, animal *energy* is due to the oxydation of muscle. Dr. Mayer in 1842 determined the mechanical eqivalent of heat, and soon after took exception to the doctrine of Liebig regarding the cause of muscular power. As early as 1845 he maintained that a muscle is only an apparatus by means of which the transformation of force is effected, but it is not the material by the change of which mechanical work is produced. The fire-place in which this combustion goes on is in the interior of the blood-vessels and blood, however—a slowly-burning liquid—being the oil in the lamp of life. Every motion in an animal is attended by the consumption of oxygen and the production of carbonic acid and water ; every muscle to which atmospheric oxygen does not gain access ceases to perform its functions. In other words, Mayer maintained that the chemical change developing force, was in the capillaries of the muscle. Quite recently Professor Frankland, of London, has thrown new light on this subject by ascertaining the amount of force generated by the oxydation of a given quantity of muscle, also the quantity of muscle oxydized in the body while the muscles are exerting a given amount of mechanical force ; thus showing very clearly that the muscle by oxydation could not furnish one-fifth of the actual force exerted. In calculating the amount of force generated in a given time by

the muscles, he makes use of data furnished by several experiments. First, by that of Fick and Wislicenus, who estimated the amount of work done by them in ascending the Faulhorn mountain in Switzerland. Second, by Dr. E. Smith, who calculated the force exerted by prisoners engaged in a treadmill. Third, by Dr. Haughton, who found the external work done by the military prisoners employed in shot-drill and fed on vegetable diet. Fourth, by Professor Playfair, who determined the average work performed by pedestrians, pile-drivers, porters, &c. Lastly, Professor Frankland gives his own experiments with various kinds of food for determination of the amount of power produced by oxydation and conversion of each. From all the facts adduced, he draws the following conclusions :

1. The muscle is a machine for the conversion of potential energy into mechanical force.

2. The mechanical force of the muscle is derived chiefly, if not entirely, from the oxydation of matters contained in the blood, and not from the oxydation of the muscles themselves.

3. In man the chief materials used for the production of muscular power are non-nitrogenous ; but nitrogenous matters can be also employed for the same purpose, and hence the greatly-increased evolution of nitrogen under the influence of a flesh diet, even with no great muscular exertion.

4. Like every other part of the body the muscles are constantly being renewed, but this renewal is not perceptibly more rapid during great muscular activity than during comparative quiescence.

5. After a supply of sufficient albuminized matters in the food of man to provide for the necessary renewal of the tissues, the best materials for the production, both of internal and external work, are non-nitrogenous matters, such as oil, fat, sugar, starch, gum, &c.

6. The non-nitrogenous matters of food which find their way into the blood, yield up all their potential energy ; the nitrogenous matters on the other hand, leave the body with a portion (one-seventh) of the potential energy unexpended.

7. The transformation of potential energy into muscular power is necessarily accompanied by the production of heat within the body, even when the muscular power is exerted externally. This is doubtless the chief, and, probably, the only source of animal heat.

Great Race Across the Atlantic.

The late contest between three American yachts, for the sum of ninety thousand dollars, has excited great attention among all interested in the improvement of vessels.

We place on record the following extracts:

[From the New York Herald.]

Description of the Contesting Yachts.

As the three yachts which have successfully crossed the Atlantic will be the theme of general conversation and admiration in all the civilized countries of the world, a description of them will not be out of place.

The Henrietta is the property of J. G. Bennett, Jr. She was built in 1862 by Henry Steers, of Greenpoint, L. I., from a model by Mr. Wm. Tooker, of this city. This beautiful vessel is of fore and aft schooner rig, and has a very deep keel. Her tonnage is two hundred and five tons; she is one hundred and eight feet long, has twenty-three feet beam, and ten feet depth of hold. She is a very beautiful model, her water lines being very fine and her entrance of more than usual elegance. In anticipation of the Atlantic race, the termination of which has so nobly proved her power of speed, the Henrietta underwent a complete overhauling and elaborate alteration. Her bowsprit was shortened, and also her lower mast and mainboom. She was also supplied with an entire new gang of rigging, made of the first quality of Italian hemp, new fore and aft and jib stays of charcoal wire, and an extra fore stay which entered at her knightheads. Her hatches were rearranged, so that in five minutes they could be thoroughly caulked and wooded, and her skylights were all caulked and battened down. Her deck cabin over the ballast was secured by extra sleepers, which were stanchioned under the deck in deep sockets.

The Fleetwing.—This beautiful vessel is the property of Mr. George A. Osgood, and is the largest of the three yachts. She was built by Joseph Van Deusen in the early months of the present year. The Fleetwing is a most beautiful craft. Her appearance as she was riding off Staten Island on the morning of the start will not be easily forgotten by those who were fortunate enough to see her. Her model is well nigh perfect, and her water lines and entrance very elegant. Like the Henrietta, she is a keel boat, her tonnage being two hundred and twelve tons.

Her length on deck is one hundred and six feet, beam twenty-four feet, depth of hold ten feet. The alterations made in this vessel previous to the late match were not nearly so numerous or extensive as those which her opponents underwent. Still, every precaution was taken that she should start in a seaworthy condition. She was furnished with an entirely new gang of rigging, and an entire new suit of sea going sails. The main boom was shortened five feet, and she was furnished with an extra shroud. Like her opponents, she underwent a thorough overhauling, and was recaulked from stem to stern.

The Vesta is the property of Mr. P. Lorilard, and has on many occasions shown herself possessed of fine sailing qualities. She was built by Mr. Carll, of City Island, from whose yard she was launched the 15th May, 1866. The Vesta differs from the other contesting yachts in a very important matter. She is a centreboard vessel, and not a keel boat, as are her opponents. Her length of deck is one hundred and eight feet, of keel ninety-eight feet, and her trunk deck is forty feet long. She is built of white oak, with chestnut and locust wood. The alterations made on board previous to the ocean race were very complete, everything being done both to insure the safety and comfort of those on board. She took on board a new bowsprit, an entire new suit of sails; also a spare set, and was furnished with a new gang of rigging. She also carried a new lifeboat and a patent water anchor.

The yachts were respectively manned as follows:

	Henrietta.	Fleetwing.	Vesta.
Captain	S. Samuels.	Mr. Thomas.	Geo. Dayton.
Sailing master	M. J. Lyons.	Mr. Nichols.	Mr. Johnson.
First mate	J. Jones.	Mr. Brown.	Mr. Hodgson.
Second mate	John Cole.	----------	----------

Beside the above they carried the following crews:

	Henrietta.	Fleetwing.	Vesta.
Boatswain	1	1	1
Carpenter	1	—	—
Sailmaker	1	—	—
Quartermasters	2	1	2
Stewards	2	1	2
Cooks	2	1	2
Men	14	14	14

[From the New York Tribune.]

The Ocean Yacht Race.

Since the days when the entire human race sailed to the peak of Ararat in a single boat, the history of the world might almost be written in the history of ships. Maritime discovery seems to have preceded, or at least attended, all great eras. But the ancients were afraid of the sea, and even when Greece was in her prime the Mediterranean was more frequently coasted than crossed. Jason, when he brought the Golden Fleece from Colchis, was thought an especial favorite of Neptune, and the coasting trade of Carthage was justly held a marvel of enterprise. In the dark ages which followed the fall of Rome, there was little enterprise on the ocean, excepting that of the Northmen who discovered Iceland, Greenland, and even in 1001, as some claim, the Continent of America. In the fifteenth century, the sea, that before had been the divider of nations—the *oceanus dissociabilis*—became the buoyant bridge that brought the uttermost ends of the earth into communication. The voyages of Columbus revolutionized the Old world by giving it the New for a rival, and there is no historian who has dared to speculate upon what would be the condition of Europe had America remained till this day undiscovered. Portugal then took the lead, and Vasco di Gama doubled the Cape of Good Hope in a vessel of which Mr. Maretzek's operatic craft was not entirely a caricature. Then Balboa beheld from the peaks of Darien the unknown Pacific, with its invisible islands, a sea destined to be the pathway of nations. The Armada, the Venetian and British naval supremacies, the circumnavigation of the globe by Cooke, are among those triumphs over the ocean to which we need not further refer, but which have brought us gradually by a gentle descent from the year 2349 B. C., when Noah sailed about in his ark, to this memorable year when three little American yachts have crossed the Atlantic and astonished and delighted two continents. In writing of such an event, a decent regard for its dignity demands a little historical preluding.

American ship-builders and sailors, and, indeed, those who have never stood on a deck, and don't know much about a taffrail, or a jibboom, to whom "avast there" and "sou'-sou'-west three points on her lee" are cabalistic expressions, will all rejoice in this victory. A victory it is, not merely of the Henrietta over the Fleetwing and Vesta, but of staunch ships over wind and sea, of enter-

prise over prejudice, of American yachtsmen over those of Europe. We have once again done the thing that nobody else dared to do, and have a right to throw up our hats in a modest way, and cheer for the Stars and Stripes. Here are three little yachts of 200 tons burden, never before more than 200 or 300 miles from land, which start out in mid-winter on a race of thousands of miles. They make steamer time across the Atlantic. The western wind, as if anxious for the honor of America, swelled their sails from Sandy Hook to the Needles, and the Henrietta, weighing her anchor at one o'clock p. m., December 11, let it go again off Cowes at 5:45 p. m. on Christmas, winning the race in the unrivaled time of thirteen days and twenty-two hours. This astonishing speed of a sailing vessel may be measured by the fact that the voyage was actually one day and a half less than that of the last but one Cunard steamer. More than this, the Henrietta, had she not been obliged to heave to for twelve hours in a heavy storm, would have so badly beaten the Java that, if steamers could blush, she would henceforth be a bright crimson color. The Fleetwing and the Vesta did almost as well, the one being but eight hours and a quarter, and the other but nine hours and three-quarters, behind the successful yacht. In a race of three thousand miles neither of the losing yachts can be said to have been distanced; if the Henrietta has most of the glory, her rivals have no discredit, and all well deserve the smiles of Royalty and the applause of the Republic. It is too early, before we know the details of the race, to speculate upon the causes of the defeat of the Fleetwing and the Vesta, but we think it probable that the Henrietta won the race on the day when she ran 280 miles. When the yachts disappeared off Sandy Hook they were close together, and the Vesta had a slight advantage in the lead. The Vesta apparently erred in choosing too southerly a course, the Fleetwing one too northerly. The Henrietta, keeping the regular steamer track, owed something of her success to that. Of the respective merits of the yachts we need not speak, except to say that the owner of the Henrietta, in announcing that he is ready to accept a challenge from any European yacht, is justified by her winning in this unprecedented time.

The general rejoicings are saddened by the loss of four men from the Fleetwing, an event common enough at sea, but made more impressive by contrast with the brilliancy of the race. We have no doubt that the New-York Yacht Club will provide for the

families of these men, and we may suppose that the winner of the match, and the enormous stakes, needs no suggestion in the premises. With the exception of this loss, nothing mars the pleasure of the race. The triumph of the American over the English yachts was not more flattering to our yachtsmen than this, and yet we must not overestimate its importance. The Henrietta is about 98 feet in length of keel, but Columbus discovered America in a four-masted vessel of but 90 feet length of keel, accompanied by two caravels, one of which was probably but half the size of the Santa Maria.

New Cooking Apparatus.

Mr. J. Newburg exhibited his apparatus for cooking meats and vegetables without the direct use of a fire. The article to be cooked is placed in an ordinary tin kettle with water, and heated to or near the boiling point; it is then placed in another vessel, which is surrounded by a substance which is a very poor conductor of heat, when the food, after remaining three or four hours in this apparatus, is found to be well cooked. In this manner a piece of meat was cooked in the room in one hour and a half.

Petroleum and Bitumen.

Mr. L. B. Page exhibited a great variety of specimens of petroleum, and described the qualities of each. Among them was the oil from Burmah, India, very clear and white, being purified as it came through the earth. There is also a heavy oil from there called tar. The oil from Mexico is of a gravity of only 45 deg. Baumé. It would seem that this oil, in its natural state, is white. The specimen shown had never been distilled, and it is perfectly white. The oil that had been passed through boneblack but once, was also very white. The dark oil shown was what is called pitch at the present time; it is very tough. This is the material that the ancients used to cement their brick. He exhibited a little ball of pitch and sand, which was found on the coast of California. It had been tossed by the rolling waves until it assumed that shape. The specimen called the Albert coal was of such a questionable character, that it gave rise to a law-suit, involving the testimony of many experts to determine whether it was coal or bitumen. The oil shown from the river Euphrates was exactly the same as our petroleum. He believed that bituminous coal came from oil, and not the oil from the coal.

An interesting discussion followed, touching the value and uses of the many oils, specimens of which had been shown by Mr. Page.

Linseed Oil.

This article having been alluded to, Mr. J. A. Miller remarked that it was a common custom in some parts of Germany to fry potatoes in linseed oil.

Dr. L. Feuchtwanger said in Europe it was usual to neutralize the smell of linseed oil, used in painting the interior of public buildings, etc., by scattering around the room a quantity of onions.

Cosmogomy.

Prof. R. P. Stevens occupied the remainder of the evening in showing that in every age certain notions had been entertained by philosophers regarding cosmogony, which had no foundation in truth. It is always essential to discriminate between the real and the imaginative in scientific investigations. To point out this more clearly, he mentioned a number of instances in which great men, trusting to their imagination for their facts, formed extraordinary theories. The stoics supposed that moisture was the agent by which the Deity acted on matter, and that the elements were convertible. In our own day men were found who have held the same views in a modified form, and maintained that from the sea was derived every organism. *E mari omnia* was the maxim of Oken, and the gentleman who has lately endeavored here to prove that continents were the results of ocean currents, belongs, without doubt, to the same school. It seems now clear that nearly every great philosopher of modern times, who has given the world valuable thoughts, has also put forth many hypothesis that were untenable. Decartes, Spinoza, Leibnitz, and even the great Kepler, entertained theories which later investigations have shown to be mere fancies, having no foundation in fact. The true path to scientific discovery is to accumulate facts and then deduce the law. The wrong one is to devise the rule and then seek for confirmatory evidence. It might be necessary, in some instances, to advance a hypothesis in order to expedite true progress; but even this should be based on correct observations.

The most noted hypothesis advanced in modern times is that of Laplace, regarding the formation of our solar system. It has now many advocates, but the following objections may be raised against its assumptions:

1st. The impossibility, reasoning from known facts or experiments, of matter being so attenuated as to fill all space.

2d. If so attenuated, it remains to be proved that there would be many or even one centre of gravity.

3d. That if attenuated and heated to so high temperature, there would be no commingling of gases, as is shown by experiment.

4th. We have no reason to suppose that molecules of matter are endowed with motion of any kind. Unless moved upon by a force outside of themselves, they are quiescent.

5th. We know the force called gravitation, but know not the *primum mobile* of the centrifugal force, or of the rototary force. All is here mere assumption.

6th. While the theory explains very well the movements of most of the heavenly bodies, it fails to account for the eccentric movement of Uranus and Neptune, and the movement of the moons of Uranus.

7th. It fails to account for the eccentric course of the comets, and their unequal rapidity of movement.

8th. It is opposed to all our present knowledge of matter, which we have reason to believe is but a reappearance of itself, in successive phases or rounds of phenomena, manifested by chemical changes and reactions.

The speaker then alluded to the changes which had occurred on the earth, asserting that land always had an existence since the creation; that it had been slowly upheaved at irregular periods, although limited areas may after have risen suddenly or spasmodically. He quoted the opinion of E. B. Hunt, Kane and Bache regarding ocean currents, and concluded by saying that the history of the earth would be embraced in four volumes. The latest and most complete is "its geography." The next preceding is "its geology," of which much is written and much remains to be written. The next, "its physical changes," or the operation of forces which first defined its form. This is yet to be furnished by the mechanician and dynamical philosopher. The fourth, "its chemical changes," is mainly unwritten, although such able writers as Hunt, of Canada, Bischoff, of Germany, and Daubree, of France, had contributed largely to it. The completion of this volume offers the grandest field to living chemists. It must be accomplished neither by shrewd guessing nor by assumption, but only by patient labor, and by generalization from a multitude of experiments.

Dr. Vander Weyde read the following paper on

The Nebular theory of La Place.

By general desire, I continue the subject of Cosmogony. Last week I spoke on the nebular hypothesis of La Place as being elevated into a theory by the new doctrine of the conservation of forces. I have been requested to explain more in detail what is meant by this last expression: It means that never any force is destroyed, that the apparent destruction of motion results usually in raise of temperature, which, by the modern improvements in philosophical apparatus, may always be traced and measured. You saw the delicate apparatus of Melloni, where the small amount of heat produced by the destruction of the motion of a leaden ball transformed into electricity, this electricity into magnetism, and finally, this disturbing the compass needle, the slightest change of temperature was made visible. The basis of the new doctrine of the correlation of forces is, that *like matter is indestructible; force is also indestructible.* Force is manifested by matter in motion, which is chiefly visible when the masses are moving; but when the visible motion is apparently stopped, the mode of this motion is only changed, it becomes molecular motion, vibration, irritation of the atoms, and as such manifests itself as heat, electricity, magnetism, etc. (Here the Dr. explained how accoustics had revealed many kinds of vibrations or waves of a nature differing respectively in another way than in mere velocity or intensity; he illustrated the character of those waves by diagrams on the blackboard. He explained how, after the manner of the sonorous wave, the luminous and caloric waves differ in velocity, amplitude, direction, etc., and gave a practical illustration of the polarization of light.)

I stated that matter was diffused into space in a nebular state, and came together by gravitation; and the most startling revelation on this subject I communicated to you, was that different kinds of elementary matter were not equally intermingled; that the nebular matter was not homogeneous, as observations with the spectroscope have proved at the present day; that the stars all consist of different kinds of matter, and are distinct from one another in their constituent elements, in the same way as different regions of our earth's surface contain differently distributed and accumulated mineral substances.

It is delightful to meditate in the light of modern chemistry on the results of chemical action, when those different elementary

substances, after leaving their nebulous, so infinitely diffused, condition, came together by gravitation, and finally reached such mutual proximity, that the different chemical affinities could manifest themselves, at an increase of temperature produced by this very condensation, resulting in a second increase in temperature by chemical action; no doubt manifold composition, decomposition and recomposition, combustion, deflagrations and explosions took place, extending over a space of billions of miles, and during a lapse of time of millions of centuries. I will now attempt to elucidate another, in its grand results very important point, namely, that not only matter was not homogeneously diffused, unequal as regard to quality, but also that it was diffused unequally into space in regard to quantity. If indeed it had been equally diffused, every particle would have been attracted equally from all sides, and the attraction of gravitation being balanced all around, would never have produced any effect whatsoever.

We are entering here upon a grand and sublime inquiry. I will attempt to explain the cause of currents, counter-currents and local currents, not extending only over a few thousand miles, like our gulf-stream, but over millions of billions of miles in the nebular matter, the condensation of which formed those round and beautiful stars which shine in the nightly heavens. They were produced by the same law of attraction which forms from the condensation of mist, nebular matter in our atmosphere, the round and beautiful waterdrops which glisten in the sunbeam and shine in the rainbow. This inquiry is not merely treating the cause of upheaving a few continents on the surface of our little earth, not even merely the creation of this world, about which Milton sang, but the creation of untold millions of suns, planetary systems, inhabited worlds. I remarked how delightful it is to meditate on such gigantic transformations, and still more so when we take the practical lesson I mentioned, by studying the formation of the little raindrops by the same power of molecular attraction. Let us imagine a clear atmosphere, where a slight fog is just commencing to show itself, which fog, becoming more dense, at last contains so many watery atoms that they mutually attract, touch, accumulate, increase to visible drops and form the rain, when the atmosphere will become clear and transparent again. I love to imagine myself present at the dawn of creation, and to see slightly visible fogs or nebulæ show themselves in numberless regions of the infinite space, in the same way as, on a much

smaller scale, we may see different light vapors floating around us when standing on one of the highest tops of the Alps or Rocky Mountains; the atoms of each nebular mass attracting one another, the, at first scarcely visible, nebula contracts, becomes more dense, and after the lapse of an almost infinite time, the final result is the formation of millions of drops of liquid melted matter of a size gigantic for us to contemplate, each drop being a sun or a world, and the amount of these worlds as numberless as that of the raindrops falling from a summer cloud.

The nebular matter originating the starry system of which our Milky Way was formed, and of which we are a part, converted thus out of irregular, cloud-like masses, of the same kind as a good telescope reveals to us at present in the remotest regions of the heavens, far beyond the last trace of stars belonging to our starry system, and which are insoluble in stars, even with the best telescopes not alone, but which the spectroscope has demonstrated to be real nebular gaseous masses, some of them containing hydrogen gas. These nebulæ, when closer investigated, consist of an accumulation of cloud-like masses, of the form called by meteorologists *cumuli*. When these masses are not very irregular but globular in form, by gravitation their constituent atoms will be condensed into single stars of enormous splendor; when not regular in outline, the first effect of beginning gravitation wil necessarily be first a contraction, till the expansive resistance of the gases commences to act, then a rounding off of their limits, protuberances and all projectory parts will disappear, and exterior cavities will be filled up, till the mass has obtained a more rounded form. In the meantime, this change may have produced a series of sideward currents on the outside, which motion, when added to the motion toward the common center of attraction, caused the moving atoms finally to describe spiral lines around and toward that centre, along which spiral line the matter moved like down an inclined plane, with accelerated velocity, at the same time communicating this motion to the more interior parts, which primitively had no other motion than toward the centre, and by inequality in the density of this portion of the mass, of course affected the resultant action of gravitation towards the main centre of a future sun.

As far as I am aware, the German philosopher, Dr. Zimmerman was the first who showed that when different parts move towards centres of attraction, some particles will move sideward in relation

Fig. 1

Original Form of globe of Oil.

Fig. 2

The globe of oil flattened by centrifugal force.

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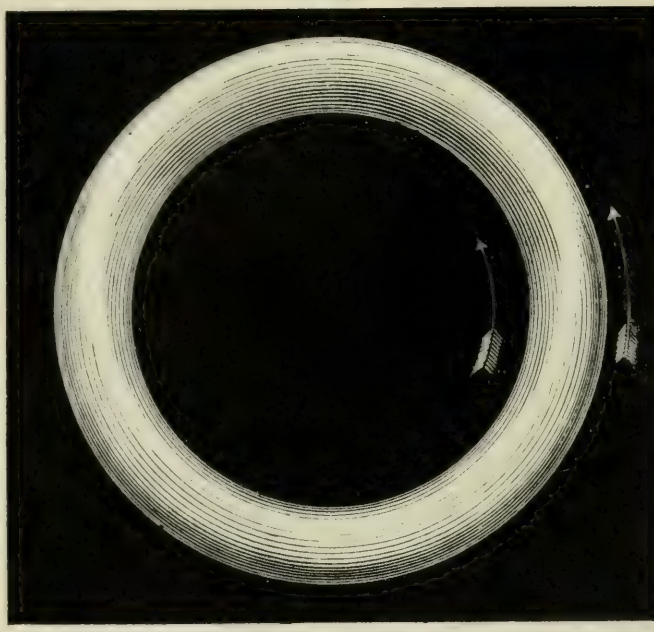
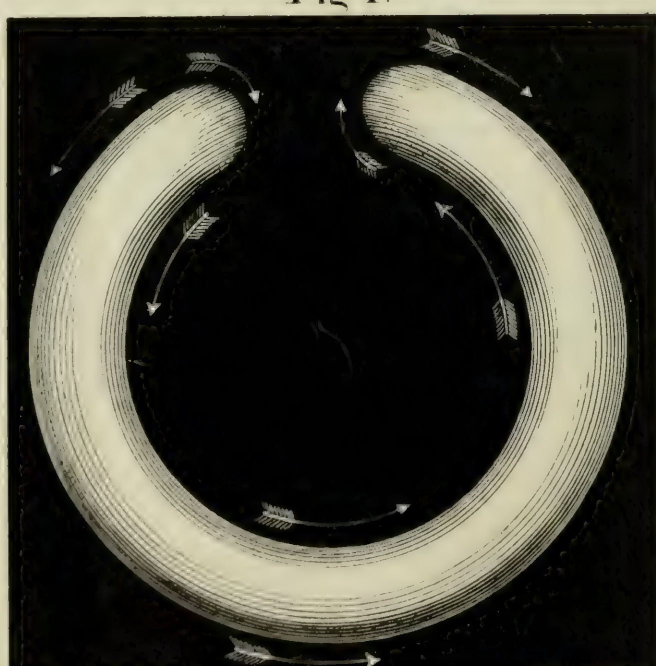
Fig. 3.



The ring of oil formed by centrifugal force

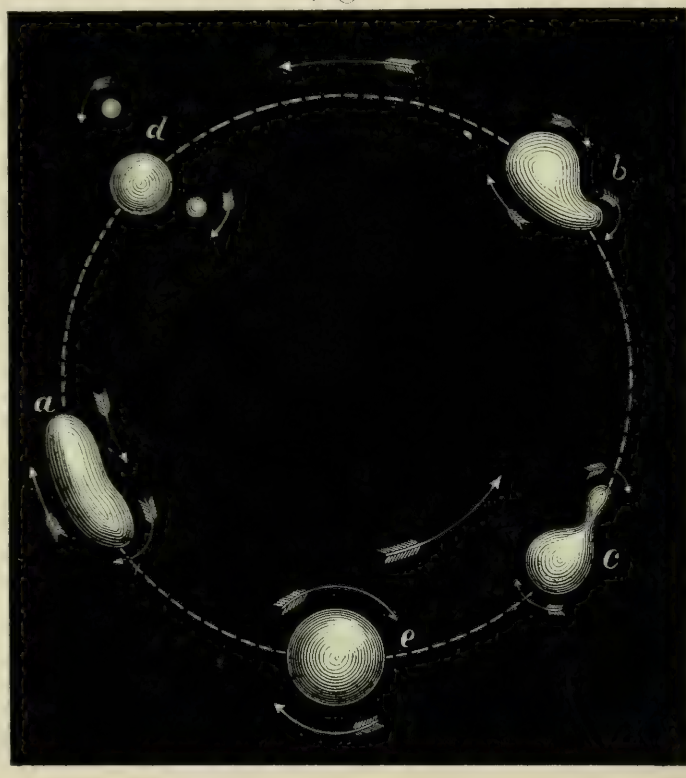
Fig. 4.



The ring broken by centrifugal force.

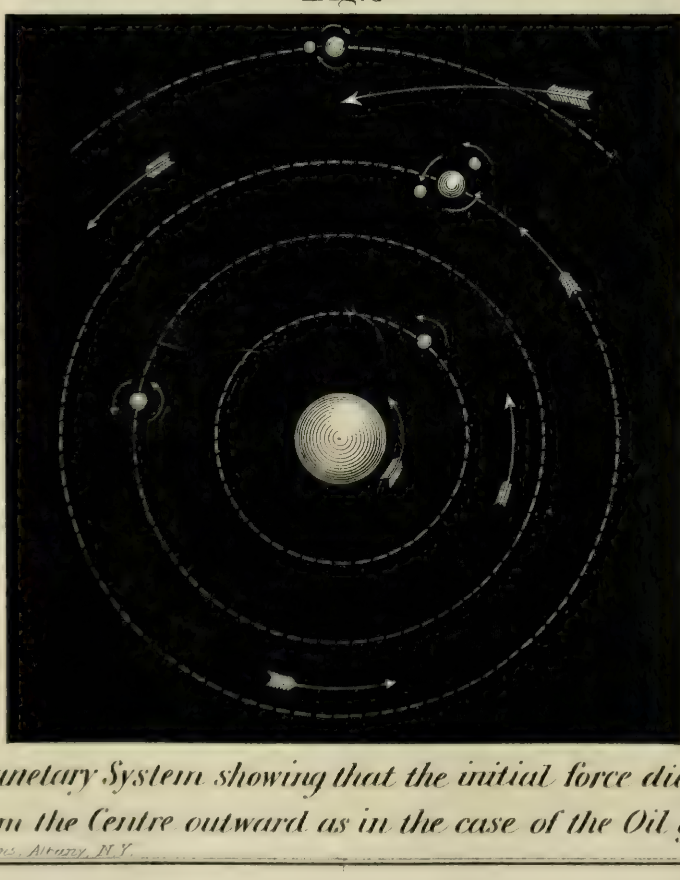
Van Benthuysen & Sons, Albany, N.Y.

Fig. 5



Remnants of the Broken Ring.

Fig. 6.



The Planetary System showing that the initial force did not act from the Centre outward as in the case of the Oil globe.

[illegible] Albany, N.Y.

to others, which sideward motion combined with gravitation toward centers of attraction, necessarily will originate rotary motions, which again combined with the force of inertia changes the globular nebulæ into spheroids, showing that the simple force of gravitation is sufficient to explain the origin of the planetary motions.

Plateau invented the beautiful experiment of an oil globe balanced in the middle of a mass of alchohol and water, so mixed as to have the same specific gravity; this globe is made to revolve by means of an axis and disk in its centre, it then flattens in the direction of its axis, expands toward its equator, and finally throws off a ring, which, by increasing velocity of its revolution, breaks up in smaller globes, all revolving around the primitive axis and each rotating in an opposite direction on an axis of its own. As the results of this experiment are of so short a duration that it is impossible for a large audience to observe the important details, I have truthful diagrams made and exhibited here, showing the resultant changes.

This experiment was supposed to illustrate some details of the nebular theory of La Place, namely, the formation of fluid rings from nebular matter, and then breaking up into planets and satelites; but it has done much injury by preventing the right understanding of the cosmogony of the universe. It has, namely, caused the impression that rings were thrown off from the revolving centre, as is the case in this experiment; that the planets were formed by rings thrown off from the sun, the satelites being rings thrown off by the planets, and Saturn was pointed out as an illustration of a planet which had thrown off a ring in the same way as the oil ring, in Plateau's experiment, which ring was not yet broken up into fragments or moons.

Now the impression that rings, moons or planets can possibly be thrown out from a central revolving body, is erroneous, because the supposed similarity between the results of Plateau's experiment and the formations of planetary systems after the nebular theory does not exist. In Plateau's experiment we start with a large fluid ball, held together by nothing but a slight cohesion; this globe is disrupted from the inside by the centrifugal force developed by the rotation of a central solid ball or disk; in the universe we have nebular matter diffused into space, and mutually acting and acted upon by the universal force of gravitation: the reaction produced by this force, commencing from the outside and

acting inward, perhaps first balling together some small liquid or solid masses, like the meteorites, and series of these meteorites revolving as rings, and attracting one another, diminished in quantity but increased in size. The largest having always the advantage, as for the very reason of their greater size, the extent of attractive power went further, and growing larger by accessions from all directions, they continually became more and more heated, by the triple cause of converging motion, pressure on their centres, and mutual chemical action by the contact of the different elements constituting them.

The final effect of the sideward motion originated on the outside of an irregular shaped gaseous mass, is easily illustrated if we imagine an inclined plane running around the whole earth, and which at its lower end would of course be several thousand feet below its beginning; a body rolling down this plane, and thus moving around the whole earth, having reached the lower end, would after the well known laws of gravitation have obtained a velocity equal to that it would have obtained by truly falling through the same few thousand feet perpendicularly downward, of course taking account in both cases of the resistance of air and friction. In the same way we obtain nearly the velocity of any of the planets in its orbit, when we add to the velocity of the next outer planet, the velocity a body would obtain, when falling through the distance between this outer planet and the inner one. This is the key to Kepler's third law, which he however only obtained in an empirical way.

[Here the Dr. explained this law, and by comparing the velocity of the different planets, showed that the facts verified the above theory.]

During the condensation of the nebular mass out of which our present planetary system has been formed, every atom moved in a spiral toward the centre, thus not only the angular velocity was increased, but also the direct velocity, after the same law as is the case with any falling body; finally the velocity became large enough to balance gravitation, and a ring of more or less stability was formed, which by breaking up gave birth to each planet.

When motion is originated from the centre of a mass and is communicated outward, the inside of each fluid ring formed, will move more rapidly than its outside, and when the ring breaks, the direction of rotation of the resulting globes, will be opposite to that of the central cause.

When, to the contrary, the motion is originated at the circumference of a mass and is communicated inward, the outside of any fluid ring formed will move more rapidly than its inside, and when this ring breaks, the resulting globes will rotate in the same direction as the central mass.

Let us now apply this reasoning to our planetary system, and test the theory that the motion originated from the outside; we see that all the planets inside of Uranus, rotate in the same direction as the sun, and also in the same direction as they revolve; this makes it probable that the first cause of rotation came from the outside of Saturn's orbit, but as Uranus rotates in an opposite and oblique direction, we see that there was a projecting part in the primitive nebula, between which and the main mass the chief current found its way; that this current was powerful is clear from the exceedingly rapid aerial rotation of the planets Saturn and Jupiter.

The comparison of Plateau's experiment with the actual state of the planetary system, teaches us that the rings out of which the moon and satellites were formed, had about the same velocity on their outside as on their inside, and the resulting satellites had consequently little rotation, if any; and this was subsequently entirely destroyed by the tides generated in their liquid mass by the main planet around which they revolved, resulting in the fact that now they all turn the same side toward the planet.

Before going farther, let me recapitulate the facts learned:

1st. Before gravitation commenced to act, matter was dispersed into the infinite space in a highly rarified degree, millions of times rarer than hydrogen, which is one-fourth of a million lighter than platinum.

2d. Matter was unequally dispersed into space, as regards quantity.

3d. Matter was also unequally distributed in regard to quality.

4th. The simple law of gravitation is sufficient to explain the formation of all solid, liquid or gaseous masses constituting our planetary system.

5th. This law is sufficient to explain the cause of the revolution of the planets around the sun, and around their own axis, and the greater velocity of revolution of the inner planets.

6th. This law is sufficient to explain after the well proved principle of the conservation of forces, all light and heat undoubtedly formerly given off by each celestial body, and now existing only

as central heat of the earth and other planets, and still radiating from the sun and fixed stars.

Consequently, this simple law of gravitation acting on nebulous matter, unequally distributed in the universe, is sufficient to explain all the results observed in the admirable system of worlds, of which the final purpose is, to be filled with organized beings. The contemplation of such a simple law, producing such grand results, must compel us to acknowledge a Divine Mind governing the universe, even when we adopt the so-called materialistic doctrine of the ancients, the chaos, or the indestructibility and eternity of matter.

Finally, we must conclude that like heat, light, electricity, magnetism, and all motion we observe on earth are produced by the influence of the light and heat of the sun, and this heat of the sun being the result of the forces which formed the sun, which forces were nothing but gravitation. *All life and motion on this earth is consequently nothing but gravitation in disguise*, and we stand on the threshold of our knowledge of the universe, not being able to penetrate any farther into the secrets of cosmogony, as indeed any cause accepted to explain this gravitation will only remove the unexplained difficulty a step further backward.

When this nebular was reduced in size but developed in beauty into a planetary system, the individual masses, at first liquid and fiery hot, would soon cool down the smallest part, after well established laws. This cooling down was modified also by their distance from some larger one, which communicated its heat by radiation; and so, no doubt, the interior small planets, Venus and Mercury, are still at a temperature far above that of the earth, only by their proximity to the sun. Prof. Loomis, of New Haven, has suggested the hypothesis that the organic life in the planets Mars, Saturn, and the asteroids, has passed away long ago; that Jupiter is doubtful; that Mars and the earth are now populated, and Venus and Mercury have to cool down for a million of years longer before being adapted to organic life. Certain it is that the capacity of a planet to sustain life is only for a very limited period, compared with the history of its formation. When the surface of a planet is cooled down between 100° and 40° F., it is fit for habitation. That the central heat, the individual temperature of a planet is essential for organism, is evident from this remark: that during the whole summer season, the sun would not have the power to melt the frozen surface, if interiorly the earth was frozen also, and had not

its own heat a few feet below the surface. We see, then, at high mountains, even under the equator, which, by their elevation, are more distant from the common source of heat of the earth, and have their interior so cooled down by radiation into space, from their exposed situation, that the full sunshine can never melt the snow on their summits, notwithstanding we know that the sunbeam there has more heating power than below, not being obstructed by the air, a fact sufficiently proved by Pouillet.

We see, then, that all animal and vegetable life on earth has its origin as well in the temperature of the earth itself, as in the heat communicated by the sunbeam; that it cannot spare the one nor the other, and only planets can possibly be provided with plants and animals during a limited period in their career when those two conditions agree.

You all know that geology proves that the earth had, in the beginning of its organized period, a much higher temperature; that palm-trees and mammoths flourished around the poles when the tropics were unfit for organic life, and an impassable barrier between the two hemispheres. Some philosophers have attempted to explain this former existence of tropical products in high latitudes by the supposition of a shifting of the poles of the earth. This idea proceeds from ignorance of the laws of motion, as I will prove now with a few experiments.

(Here the Doctor demonstrated practically by experiments with a beautiful rotation apparatus, that all bodies tend to rotate around their shortest axis, and that this tendency is strong enough to overcome a considerable amount of gravitation. Spheroidal bodies, rings, and chains, when rotated around a longer axis, would shift this axis till they rotated around the shortest, and an imitation of Saturn and its rings, by rotating it rapidly, was made to lift itself up against gravitation.)

By the contraction of the bulk of the earth, its rotary motion did accelerate; its crust, when once surrounding it as a whole shell, became rimpled, and the principal mountain ridges did appear by lateral pressure. By continued contraction those ridges, once formed, rose higher and higher, and the depression deeper, long before any ocean was precipitated on its surface. After atmospheric and aquatic influences had acted for some thousands of years on the elevated rocks, crumbling them, dissolving many substances by the high temperature and pressure then prevailing in a boiling ocean under an enormous atmospheric pressure, they were precipi-

tated in the form of granite, gneiss, and many other rocks, therefore erroneously supposed to be igneous. Many changes took place which the beautiful science of geology studies and tries to explain. Rocks once formed by deposit from water were elevated to enormous heights; brooks and rivers originated; mountains were again crumbled down, washing earth and pulverulent matters in the lowest places, and formed deposits, partially filling up some depressions. Some of those basins filled up with deposits of carbonate of lime, full of remnants of ocean shells, were again elevated and formed on lime rocks, of which the enormous Catskill Mountains in our State are but a small illustration, elevating the aqueous deposits to some 4,000 or 5,000 feet above the surface of the ocean.

Another force causing this upheaving of mountains must not be overlooked, namely the volcanic action; I need not repeat to you the accounts of mountains elevated, lavas ejected in enormous quantities in different localities, which of course you have all read about, and will only remark that the volcanic action we see now, is only an insignificant remnant of what it was once; it appears to have been exceedingly active in the moon, as the inspection with the telescope reveals a greater number of extinguished volcanoes than are on our earth; however we must take in account that here on earth the water has washed away and submerged many volcanic testimonials, a cause not acting in the moon, which is entirely dry.

The chief cause that this volcanic action has almost ceased, is that the crust of the earth is much thicker than some philosophers have lately supposed. You are probably aware that the heat increases one degree Fahrenheit for every thirty or forty feet we descend in the earth, and this law holds for so far as we have been able to verify it, that is for the insignificant amount of about 2,000 feet deep; it has been concluded from this fact, that when this increase goes on at the same ratio, at the depth of a few miles, every thing is in a melted condition, and as the earth has a diameter of 8,000 miles, that we live on a comparatively thin crust; but where is the guarantee that this increase in temperature goes on after the same law? Laplace presented his hypothesis with diffidence, stating that it is imprudent to go beyond direct observation or calculation; but calculation comes here to settle the matter, and Hopkins, in England, has calculated from the precision of the equinoxes, that the crust can not possibly be thinner than 800 to 1,000 miles. This calculation does not however exclude

the possibility that masses of melted matter may be distributed through this crust, and give still cause to volcanic eruptions, when reached by water, penetrating through the fissures in the ground.

The extent over which an earthquake is felt, depends on the depth where it originates; at a small depth it will only be felt over a small surface; but an earthquake as that which destroyed Lisbon in 1755, and was felt after the computation of Humbolt over a surface four times greater than Europe; from the Alps to Sweden, Canada, the West Indies, the north of Africa; and on the whole northern Atlantic ocean the shocks were felt by vessels. This suggests an origin of great depth, and thus a crust of several hundred miles in thickness.

Another calculation lately made as to the thickness of the earth's crust, is based on an estimation of the weight of the Himalaya mountains, a range the most extensive and highest in the world, which it has been proved could not be supported by a crust of only a few miles in thickness, without depressing it, and raising the bed of the Indian ocean; it has been calculated that it requires a crust of some 400 miles in thickness to support this enormous weight alone.

Adjourned.

American Institute, Polytechnic Association,
January 10, 1867.

Prof. S. D. Tillman, Chairman; T. D. Stetson, Esq., Secretary.

The chairman opened the proceedings by the presentation of the following scientific summary:

Corundum.

Dr. C. T. Jackson lately found a perfect crystal of blue corundum or sapphire (pure alemit) in the new emery mine at Chester, Mass. Its form is that of a double pyramid with six planes. This, with other specimens from that mine, will be sent by the Emery Company to the Paris Exposition.

New Artificial Solid.

Gypsum, if mixed with a certain quantity of water and soaked in a bath of hot pitch, parts with its water, and, absorbing pitch in corresponding quantity, forms a substance so hard that it will receive a polish and can be used in the manufacture of useful and ornamental articles.

Preservation of Milk.

The germs to which Mr. Williamson attributes the fermentation of milk are not destroyed by ordinary boiling, but if the milk be boiled under a pressure of about 22 pounds to the inch, he asserts their destruction is effected, after which the milk may be preserved in air-tight cans any length of time.

Magnet made of Iron Shavings.

A new magnet of considerable power has been introduced by M. Greiss, which is composed of the long spirals formed by a chisel in turning iron. He states that the magnetism of these spirals is of a very permanent nature. The end of the spiral which the chisel first touches is invariably the south pole.

Explorations in Africa.

The Geographical Society of France are raising funds to enable M. Lessaint to explore certain unknown parts of Central Africa, especially the territory between the basin of the Upper Nile and the French colony of Gaboon. M. Lessaint believes the central platteau is fertile, and its inhabitants will doubtless furnish interesting subjects for ethnologists.

Artificial Mixture for Busts.

Chloride of magnesium, is convertible into anhydrous of magnesia, which, when soaked in water and formed into lumps, becomes hard and transparent as alabaster. This, if pulverized and mixed with an equal quantity of powdered marble, forms, a substance which, after being pressed into a mold and exposed for some time to the action of water, is suitable for statuary.

Laurite.

A new mineral has been discovered by Wohler in the fine grained platinum ore from Borneo, to which he has given the name *laurite*. It is a sulphide of ruthenium and osmium, consisting of small grains of iron-black color, of high lustre, harder than quartz. Its analysis gave ruthenium 65.18, osmium 3.03, sulphur 31.79. This is the first sulphide found in the group of platina metals.

To restore Stained Glass.

M. Chevreul states that old and dim stained glass of windows can be restored to its original brilliancy by a simple process. The

glass is taken from the window, and plunged for several days in a weak solution of carbonate of soda; it is next washed in clean water and afterwards dipped for some days in a solution of hydrochloric acid sp. gr. 1,080. In this way the colors become as beautiful as when they were first transmitted.

Tough Soap-Bubbles.

Those who have experimented with ephemeral refracting spheres blown from common soap and water, will be glad to know that bubbles of extraordinary size and strength can be formed from a mixture of oleate of soda and glycerine. They may be kept on glass or under bell-jars for 24 hours. When dropped upon the floor they rebound like a ball. If carefully cut open with a pair of scissors, wet with the solution, smaller spheres may be blown inside. Under the microscope the movements and iridescence of a small bubble present many beautiful changes.

Perchlorate of Thallium.

Prof. H. E. Roscoe regards this salt as isomorphous with the potassium and ammonium perchlorates. The angles observed by Mitscherlich in case of the latter, agree exactly with those of the crystalline thallium perchlorate. The isomorphism of ammonium and thallium sulphates having been previously determined, these resemblances in structure, as well the fact that thallium alum has been formed, furnish strong grounds for placing thallium in the group of alkaline metals. Although it is devoid of prominent alkaline characteristics, doubtless the similarity in the structure of the salts mentioned arises from the fact that it, like all the alkaline metals, is monatomic. Odling, however, regards thallium as a triatomic metal or a triad, like antimony and bismuth.

Blasting with Coal.

M. Lapparent, of France, has invented a movable furnace for disintegrating very hard rock by means of heat, in cases where it is not practicable to use gunpowder. The furnace, on wheels, is placed directly in front of the rock to be removed, and after the coal is well ignited, a jet of compressed air and drops of water are forced into the fire, and the whole of the products of combustion are brought to bear against the rock. In a few seconds the splinters and fragments begin to fly in all directions above and below the furnace. When the rock is very hard, the attendant wears a

wire mask, similar to those used in fencing. The heated rock is afterward cooled by a jet of cold water ; the disintegrated portions are then removed, and the furnace is advanced to resume operations. In confined places and galleries, the attendants are supplied with air for breathing by special tubes. This apparatus can double, treble, and sometimes quadruple the work of gunpowder in the same space of time.

Origin of Anthracite.

Dr. Percy, F. R. S., in his tenth lecture on Chemical Geology, after describing an experiment of Daubree, who subjected fragments of firwood in a close tube with water, to a high temperature and pressure, and thus transformed the wood into a black mass, having a bright luster and resembling anthracite, proceeds to say : It has long been supposed that bituminous coal is converted into anthracite simply by application of heat ; but something more than this is required to satisfy the conditions, for if it were simply a matter of heat we ought to get, not anthracite but coke, also a proportionate increase in the quantity of fixed organic matter, or ash, in the coal. It seemed to him there must have been some other condition obtaining in order to account for the conversion of bituminous coal into anthracite. He believed that water played an important part in this conversion ; that anthracite has been the result of thermo-hydric or hydro-thermic action, and that water has in some way or other removed to a large extent the inorganic matter or ash.

Crystalline Red Phosphorus.

The red phosphorus obtained by Schrotter's process, having many properties differing from those of ordinary phosphorus, is always in the amorphous condition. Blodlot has, however, lately succeeded in changing white into red phosphorus without loosing its crystalline form, by the mere action of light. Ordinary phosphorus, after being carefully dried, was placed in a flask, the neck of which was drawn out and sealed. After twenty-four hours the oxygen within the flask was absorbed and all phosphrescence had disappeared. The flask was then placed in a water-bath of the temperature at which phosphorus melts, and the whole protected from light. After a few hours, small brilliant points were observed in the upper part of the flask ; these increased in number and size until at the end of a few days they had changed into a magnificent white crystalline arborization, covering all the sur

face, and shining with all kinds of reflection, and a luster like that of the diamond. When exposed to the sun's rays, they became almost instantly garnet red; retaining, however, all their luster, they resembled small rubies. In this condition it was found to have the peculiar properties of the amorphous red phosphorus.

Thallium Glass.

Thallium has been used by M. Lamy, of France, in the manufacture of glass for special uses. Having observed that ethylthalic alcohol is more highly refringent than any other known liquid, and that great refractive and dispersive powers belong to other compounds containing thallium, he commenced a series of experiments in which he used that metal in various proportions in making glass. A mixture consisting of 300 parts of sand, 335 parts of carbonate of thallium, and 200 parts of oxide of lead, produced a glass perfectly homogeneous throughout, transmitting light of extreme brilliancy, although of yellowish tint. Its density was 4.235, and the refractive index of the yellow ray was 1.71, which is higher than that of any other glass not containing borates. He subsequently made glass having a density of 5.625, and a refective index of 1.965. His general conclusions are:

1. That thallium replaces potassium better than it replaces lead, and that thallium glass is denser and more refringent than potassium glass.
2. That thallium glass always gives a yellowish tint, as sodium glass gives a greenish color.
3. That thallium glass will be useful in making certain optical instruments and artificial gems.

Spectra of Heavenly Bodies.

A lecture before the British Association on the results of spectrum analysis, as applied to the heavenly bodies, by William Huggins, F. R. S., lately published, concludes as follows:

1. All the brighter stars, at least, have a structure analogous to that of the sun.
2. The stars contain material elements common to the sun and earth.
3. The colors of the stars have their origin in the chemical constitution of the atmosphere which surrounds them.
4. The changes in brightness of some of the variable stars are attended with changes in the lines of absorption of their spectra.

5. The phenomena of the star in Corona appear to show that in this object, at least, great physical changes are in operation.

6. There exist in the heavens true nebulæ. These objects consist of luminous gas.

7. The material of comets is very similar to the matter of the gaseous nebulæ, and may be identical with it.

8. The bright points of the star clusters may not be in all cases stars of the same order as the separate bright stars.

It may be asked what cosmical theory of the origin and relations of the heavenly bodies do these new facts suggest. It would be easy to speculate, but it appears to me that it would not be philosophical to dogmatize at present on a subject of which we know so little. Our views of the universe are undergoing important changes. Let us wait for more facts, with minds unfettered by any dogmatic theory, and therefore free to receive the obvious teaching, whatever it may be, of new observations.

The Diamond.

This precious gem, consisting of pure carbon, is generally associated with a quartose rock called itacolumite, from Itacolumi, a mountain in Brazil. It is a kind of sandstone which often contains talc, chlorite, and mica. A thin strip of it will sometimes bend without breaking, and is known by the common name of flexible sandstone. Diamonds have been found in Brazil, India, Borneo, Russia, and occasionally in North Carolina, Georgia, and Virginia. With regard to their formation, Dr. Percy, in a late lecture, said: "The question is, if this itacolumite be, as there is no doubt it is, a rock of sedimentary origin, have the diamonds been developed in the rock, by some means or other, subsequent to its formation, or were they deposited there cotemporaneously with it?" That is the point, and so far as he knew, it is a point which has not been clearly made out at present. All attempts concerning the artificial production of the diamond have hitherto proved most singularly abortive, and we have not the slightest clue in the world to the mode in which the diamond has been made in nature. It is evident that the condition or conditions of its formation must be excessively rare, because the quantity of diamonds is, comparatively speaking, so small. He could not help thinking—and it is the opinion of those who have directed attention to this subject—that one day or other we shall be able to crystallize carbon; but it does not follow that we should be able to

crystallize diamonds of any value. It may be that the crystallization of diamonds of large size is a work of time—such work as only nature can accomplish in a satisfactory way. No doubt fluorine, or some similar element, has played a part in the production of the diamond. It is a suggestion worthy of attention. Compounds of that element are very imperfectly known at present. In chemical works, at different times, processes are described whereby carbon has been separated from combination, and obtained in a crystallized form; but all these statements, he believed, were entirely erroneous. Liebig has a notion that diamond is the result of the final natural decay of vegetable matter; but in nature we do not find diamonds under those conditions where we observe the final products of natural decay—in our coal-fields, for example, anthracite is one of the final results of this decay; and no one, he believed, had ever found diamond in a coal-field, where one ought to find it, if it is the result of this final decay. We find graphite in nature, which is a crystalline form of carbon, just where we should expect to find it, but we do not find the diamond there.

Metallic Tree.

Dr. Vanderweyde alluded to the fourth item read, and described a tree he had recently seen, fourteen inches high, formed of iron filings, at the manufactory of Mr. T. N. Hickcox, in John street, New York. The filings fell in such regular order so as to form a tree. The iron becoming magnetic caused them to hold to each other.

Calculating Tables.

Mr. J. Johnson exhibited a set of calculating and multiplying rotary cards for teaching children to add, multiply, and divide figures expeditiously.

Prof. Grimes remarked that Mr. Byington, a teacher of a school at Cold Spring, N. Y., had a system of teaching addition by a sort of mnemonics. He had seen quite a large number of figures added up in ten seconds. Mr. Byington's method was to accustom the pupils to look upon two or more figures as a whole—such as 8 and 8 are sixteen. By a little practice, several figures are intuitively associated together at a glance, and rapid calculation thereby much facilitated.

Plastic Anatomy.

Mr. Julien Lédion said he had the honor to call the attention of the Polytechnic Association to his specimen of pathological anato-

my, now exhibited. He had been engaged for upwards of twenty years in the preparation of models in painted relievo for the medical schools in France. The material which these pieces are made of, and the system of painting, are his own and exclusive property. They present over wax models the following advantages:

1st. Wax specimens are modeled, and are imitations very fine indeed, but not perfect.

2d. The process of manufacturing is very slow, and the disease that you wish to reproduce changes in aspect, in color, in form before the piece is completed.

3d. Wax specimens are easily spoiled at the contact of atmospheric air, they are altered by heat, and loose their color in course of time. Those colors are too bright, too fine; what the physician wants in nature, not the ideal of the artist, he wants to see the disease in all the horrors of its reality.

The specimens we present to you to-night, are made from impressions taken last summer in one of the hospitals of Paris, they are made in a composition inalterable under the influence of heat under any climate. They may be handled, cleaned when soiled, and carried about without any inconvenience. They are exact and minute reproductions of the diseased parts, as may be ascertained by looking at them through a magnifying glass, and their last, but not least, advantage, is they are much cheaper than wax.

Having brought his industry to this country, he respectfully submitted these specimens of his work hoping that the members present would aid him to become known among the scientific men of the United States.

J. Stanley Grimes, Esq., took the floor and gave the following new deductions touching the

FORMATION OF THE SOLAR SYSTEM.

The new theory which I propose concerning the formation of the solar system is all embraced in the following proposition: *The relative magnitudes, densities and distances of the sun and planets, are such as would necessarily result from the axial rotation of a nebulous mass in a resisting medium.*

If we admit the existence of an etherial fluid,—such as that the vibrations of which produce light and heat,—we must also admit that it will present a slight resistance to the passage of a body through it. By regarding the etherial fluid as analogous to atmospheric air, we can readily understand that the lighter a body is

the greater will be the retarding effect of the resistance. We can also understand that the resistance of the medium will be in a direct ratio to the velocity of the body that moves through it. One of the objections which it is said that Newton made to the now received theory of light, namely, that it is the vibratory or undulating motion of an etherial fluid, was, that such a fluid medium would deflect the planets from their normal and proper orbits, and cause them to move by spiral paths to the sun. The undulatory theory of light is now firmly established; and the existence of a resisting medium cannot, therefore, be denied. Indeed, it seems impossible to avoid the conclusion that the fact of gravitation, itself, demonstrates the necessary existence of a medium through which that force is communicated from one planet to another; for it is certain that force cannot be communicated except through a material medium.

When it was found that Encke's comet approached nearer the sun with each revolution,—so that in thirty thousand years it must fall into it,—the ablest astronomers in Europe, after exhausting all other modes of explanation, finally concluded that the comet, being exceedingly light, is deflected inward by the resistance of the etherial air which it encounters in space; and that it is, therefore, actually pursuing a spiral path toward the sun.

"Now it appears probable," said Dr. Nichol, "that this comet *is approaching the Sun:* on every successive appearance, its orbit appears somewhat contracted; and there is reason to believe that the contraction will go on until it is either absorbed in that luminary, or altogether dissipated by its beams. And after searching earnestly for some other cause, most inquirers are inclined to refer this extraordinary and hitherto unparalleled change, to a *resisting medium or ether* occupying the planetary spaces. 'I cannot but express my belief,' said Professor Airy, 'that the principal part of the theory, viz., an effect exactly similar to that which a resisting medium would produce—is perfectly established by the reasoning in Encke's memoir;' and similar opinions have been offered by other great authorities. * * * How singular is it that we should have been guided to a truth so remote and difficult—one concerning which the grander phenomena of our system are silent—by the motions of a wandering object, in comparison with whose etherial nature, even one of these light flocculi or flakes of cloud, which scarce stain the sky of a summer evening, is heavy and substantial!"

When the nebulous wheel, from whence the solar system was formed, commenced its rotation, it must have been composed of matter which was exceedingly attenuated; quite as much so as that of any comet, and, if possible, more so: it is, therefore, perfectly reasonable to presume that it was subjected to the influence of the same resisting medium which now has such a decided effect upon Encke's comet.

If, at the commencement of its rotation, the nebula was no more dense or massive in the centre than elsewhere, the first effect of the resisting medium would be to cause a large portion of the lighter matter to accumulate there, and assume the office of a primary body—a sun. The attraction of this central mass would at once establish orbital motions in all the surrounding nebulous matter, whatever might be its form or condition. The laws of Kepler, so called, that now govern the motions of all secondary planets, must have controlled the motions of the secondary nebulous matter, that was thus necessarily forced to move in orbits or rings around the central body. According to these laws, the portions that were nearest to the centre, but not actually attached to it, must have moved around it with the greatest velocity; and those portions which were most remote, with the least velocity.

Sir Charles Lyell, in his "Principles of Geology," objected to the prevailing opinions concerning geological catastrophies; and insisted that it was more philosophical to account for the changes which the earth has undergone, by referring them to the operation of still existing causes. I am not only a convert to his doctrine, but I would apply it to the formation of the planets. The same causes which now produce the differences of orbital velocities, were in operation before the planets were formed, and caused differences in the velocities of the chaotic materials of which the planets were subsequently composed. If all the planets could now be crumbled to dust, and that dust be scattered equally between the orbit of Neptune and that of Mercury,—each separate particle of the dust would have a tendency to move in an orbit of its own. This tendency would, in some degree, be overcome by the mutual attraction of the particles for each other; and the result would be the formation of a series of concentric rings, differing in width and velocities: the width of the rings would increase, and the velocities decrease, in accordance with their increasing distances from the sun. In fact, the same law prevailed during the formation of the planets as that which now determines their relative velocities.

The velocity of Mercury is nine times greater than that of Neptune,—five times greater than that of Saturn; three and a half times greater than that of Jupiter; and twice as great as that of Mars. At the distance of nine millions of miles from the sun, the velocity of a body would be twice as great as that of Mercury; and at the distance of four millions it would be four times as great, or more than four hundred thousand miles an hour. It is plain, therefore, that the resisting medium would produce its greatest effects between the sun and the orbit of Jupiter; and that its effects would be gradually less as the orbital velocities decreased with the distances from the sun.

To form a correct idea of the actual effects of the resisting medium, upon the form and proportions of the embryo solar system, or nebulous wheel,—we must consider what would necessarily have been the form of the nebula, if the resisting medium had not produced any effect upon its proportions.

It is well known to mechanical philosophers that a fluid mass, rotating rapidly on its axis, must necessarily *tend* to assume the form of an oblate spheroid,—a double convex lens—a wheel, thickest in the centre, and gradually thinner to the outer edge. This would have been the form of the embryo solar system, had it not been for the resisting etherial medium, and the greater orbital velocities of the secondary matter near the sun. In the very place (between the sun and Jupiter) where the planetary matter would otherwise have been most abundant, the resisting medium caused it to be the least in quantity. The nebulous wheel, instead of being thickest at the centre and gradually thinner from the centre outwards, was, by the resisting medium, made thickest at the centre and at the orbit of Jupiter, and very thin between the sun and Jupiter, where the four small, dense planets are now situated.

Cause of the Relative Densities of the Planets.

Let us consider the effect of the resisting medium, combined with the differences of orbital velocities upon the relative densities of the planets. The matter comprising the embryo solar system was undoubtedly possessed of different degrees of density. The natural tendency of the condensing nebulous matter would be to form itself into a countless number of meteoric or comet-like masses — each separate mass consisting of a dense central nucleus, and a less dense atmospheric envelope. Such, in fact, is

now the actual constitution of the comets. The nebula became a vast wilderness of comets. As the resisting medium affected the lighter and more expanded matter more than it did the denser, it follows that there was a tendency of the atmospheric envelope, or outer portion of each mass, to become separated from the denser nucleus, and to move to the sun—leaving the denser portions behind to constitute planets and planetettes. The greater orbital velocities of the nebulous matter near the primary, caused all but the very densest portion of it to be swept into the sun. As the distance from the sun increased, the influence of orbital velocity was lessened, and the densities tended to decrease in the same ratio.

Let us examine a table (1) of the densities (according to Humboldt), and compare them with the velocities of the same planets, to see how far they confirm this theory.

TABLE 1.

	Densities.	Orbital Velocities.
Mercury	123	110
Venus	94	81
Earth	100	68
Mars	96	55
Jupiter	24	30
Saturn	14	22
Uranus	18	15
Neptune	23	12

It will be seen that from Mercury to Saturn the actual densities are generally accordant with our views; beyond this point they increase in density, and thus appear at first thought to contradict theory. But, upon a more careful examination, we find that this apparent discrepancy is in reality a confirmation. The matter swept into the sun from the interior parts of the system was, in some degree, replaced by that swept inward from the middle regions; and that swept inward from the middle regions was replaced by that from the outer regions; but the light matter swept inward from the outer regions could not be replaced; and, therefore, the outer planets would be more dense than those in the middle, while those in the interior would be the densest of all.

The internal heat of celestial bodies must make some difference in their densities. The density of the sun is about the same as that of Jupiter; and this is readily accounted for by the amazing

heat which counteracts the vast force of gravity that presses toward his centre. In another paper, I have attempted to show that all celestial bodies generate heat internally, in the direct ratio of their masses, by the assimilation and condensation of ethereal matter, and the conversion of its expansive force into radiant force. If this is true, the larger planets will, all else equal, be less dense than the smaller ones. The mutual attractions and perturbations of the embryo planets, during the countless ages of their progressive formation, must have had some influence upon their relative magnitudes and densities, and, perhaps, also upon their intervals. The attraction of an immense exterior mass, like Jupiter, would certainly prevent much of the light matter from reaching the orbit of Mars; this would not only account for the anomalous smallness, but also for the great density of Mars. The second satellite of Jupiter occupies an analogous relative position; and, like Mars, it is remarkably small and dense. At the first thought, it would seem that, according to this theory, the magnitudes of the planets should be successively greater from Mercury to Neptune; whereas, they only increase outwardly to Jupiter, and then decrease. A little examination will show us that the facts are in strict accordance with the requirements of theory. It should be recollected that the tendency of rotation was to make the nebulous wheel thickest in the centre and gradually thinner to the outer edge; and that the influence of the resisting medium did not change this form, except between the orbit of Jupiter and the sun. Beyond Jupiter the form remained the same as if there had been no resisting medium; that is to say, the wheel became gradually thinner from Jupiter to the outer edge. This is in accordance with the fact that Saturn is smaller than Jupiter, and Uranus and Neptune smaller than either.

This theory is doubly confirmed by the satellitic systems of Jupiter and Saturn. In each of these, the distribution of matter is essentially the same as in the solar system. There is, first, a central primary, containing many times more matter than all the the secondaries together; second, there are several small secondaries near the primary; third, there is one giant secondary, containing more matter than all the other secondaries of that system together; fourth, beyond the giant are one or more smaller bodies with wide intervals.

Inter-planetary Spaces, and the Relative Orbital Velocities of the Primitive Rings and Planets.

I agree with Laplace that the nebula was first divided into rings, and that each planet was formed by the concentration of the matter of a single ring into a globular mass; so that the intervals, could they all be accurately known, would indicate the width of the rings that once filled the same spaces. But I propose to give a very different explanation from that of Laplace, of the manner in which the rings were separated from the parent nebula and from each other. My idea is that a nebula could not rotate in a resisting medium without having a large proportion of its lighter matter drawn into its centre. The great central mass, thus accumulated, would necessarily assume the office and power of a primary planet, and compel all the nebulous matter in the neighborhood to perform the offices of secondary bodies; that is to say, the matter near the sun would either rush into its bosom, or revolve in concentric orbits around the centre.

The mutual attraction of all the parts of the nebula would tend to bind it together, in rigid connection with the central mass, like the parts of a vast planet. This aggregating tendency would be opposed by the tendency of the matter, at different distances from the sun to move with different orbital velocities. The greater the difference of any two portions of the nebulous matter in their distances from the sun, the greater must have been their tendencies to a difference of orbital velocities. If the cohesive or aggregating tendency could have been sufficiently powerful, the whole nebula would have remained in a single mass. If, on the contrary, the tendency to differ in orbital motion could have been unopposed, there would have been a division of the nebula into an almost infinite number of concentric rings, each of which would have moved with a greater velocity the nearer it was to the sun. These two forces antagonized each other; one tending to prevent the formation of any rings, and the other tending to the formation of a countless number of rings of extreme narrowness; the necessary result of the antagonism was a compromise. A limited number of rings were formed, which were wider the farther removed they were from the central primary. Let us illustrate this proposition. If a row of bodies could be arranged so as to extend in a radial line from the sun to the orbit of Neptune, the mutual attraction of those bodies would *tend* to preserve the line unbroken; but the differences in their orbital velocities would not permit this. The

line would be broken up into a definite number of shorter lines: the longest line in the series being the one most distant from the sun, and the shortest the one nearest to the sun. The length of the lines would be regulated by the ratio in which the velocities decreased with distances. This is a perfect illustration of the manner in which rings were formed.

Intervals and Common Difference of the Orbital Velocities.

Let us denominate the nebulous matter that moved around the embryo sun *secondary* matter. Let us represent the force of aggregation, or mutual attraction between the particles of the secondary matter, by the number 1,582. This aggregating tendency was the same in all parts of the disk of secondary matter; it was equal to 1,582 in the inner, the middle and the outer parts. The tendency of this cohesive force of 1,582 was to prevent the formation of rings. Of course, no rings could be formed without overcoming it. The differences in orbital velocities were opposed to it. But it required a certain *difference of distance* from the sun to obtain a *difference of velocities* sufficient to antagonize 1,582. Not only so, it required a greater difference of distance to overcome 1,582, the further the secondary matter was situated from the sun. Whenever the difference of distance was so great in any place as to cause a difference of orbital velocities equal to 1,582 miles per hour, aggregation or cohesion was overcome, and a separate ring was formed. It follows, that since there was a common force of 1,582 to overcome, there must have been a common force at least equal to 1,582 to overcome it; and any two consecutive rings must, all else equal, have differed in orbital velocities 1,582. If all the rings had been formed into planets, they would also have differed 1,582. If several rings, from any cause, were prevented from becoming planets, then those planets that *were* formed would differ in their orbital velocities twice 1,582, or thrice, or four times, or some greater multiple of 1,582. By referring to the following tables, it will be seen that the actual velocities of the known planets and satellites are in remarkable accordance with this theory. It will be noticed that each system has a different *number* for its common difference, though all are subject to the same *law*.

Explanation of Table 2.

In the following table, the difference between the velocity of Mercury and that of Venus is put down as 1,582, multiplied by 19,

which is equal to 30,058. This being deducted from the velocity of Mercury, leaves 80,682 for the velocity of Venus. Again, 1,582 is multiplied by 8, and the product, 12,656, is deducted from 80,682, leaving 68,026 for the velocity of the earth. Proceeding in this manner, I show that 1,582 comes very near being a common divisor of all the differences of the orbital velocities; so near, indeed, as to force upon us the belief that the rings, from which the planets were formed, must have originally had a common difference of their orbital velocities of very nearly 1,582.

In a parallel column I have placed the actual velocities, taken from Dr. Lardner's hand book of Astronomy, to show how closely they agree with those derived from theory.

TABLE 2.

Relative orbital velocities.

	Theoretical velocities. Miles per hour.	Actual velocities. Miles per hour.
1.—Velocity of Mercury	110,740	110,725
Subtract 1,582 × 19=	30,058	
2.—Velocity of Venus	80,682	81,000
Subtract 1,582 × 8=	12,656	
3.—Velocity of Earth	68,026	68,090
Subtract 1,582 × 8=	12,656	
4.—Velocity of Mars	55,370	55,812
Subtract 1,582 × 16=	25,312	
5.—Velocity of Jupiter	30,058	30,203
Subtract 1,582 × 5=	7,910	
6.—Velocity of Saturn	22,148	22,306
Subtract 1,582 × 4=	6,328	
7.—Velocity of Uranus	15,820	15,730
Subtract 1,582 × 2=	3,164	
8.—Velocity of Neptune	12,656	12,570

TABLE 3.

Relative orbital velocities of the satellites of Jupiter.

	Theoretical velocities. Miles per hour.	Actual velocities. Miles per hour.
1.—Velocity of Io	38,772	38,772
Subtract	7,000	
2.—Velocity of Europa	31,772	30,716
Subtract	7,000	
3.—Velocity of Ganymede	24,772	24,513
Subtract	7,000	
4.—Velocity of Callisto	17,772	17,743

TABLE 4.

Relative orbital velocities of the satellites of Saturn.

	Theoretical velocities. Miles per hour.	Actual velocities. Miles per hour.
1.—Velocity of Mimas	34,986	34,986
Subtract 714×5=	3,570	
2.—Velocity of Enceladus	31,416	30,975
Subtract 714×5=	3,570	
3.—Velocity of Tethys	27,846	27,776
Subtract 714×5=	3,570	
4.—Velocity of Dione	24,276	24,516
Subtract 714×5=	3,570	
5.—Velocity of Rhea	20,706	20,763
Subtract 714×10=	7,140	
6.—Velocity of Titan	13,566	13,635
Subtract 714×2=	1,428	
7.—Velocity of Hyperion	12,138	12,215
Subtract 714×6=	4,284	
8.—Velocity of Japetus	7,854	7,968

TABLE 5.

Relative velocities of the satellites of Uranus.

	Theoretical velocities. Miles per hour.	Actual velocities. Miles per hour.
1.—Velocity of the 1st	12,500	12,500
Subtract 600×2=	1,200	
2.—Velocity of the 2d	11,300	11,200
Subtract 600×2=	1,200	
3.—Velocity of the 3d	10,100	10,056
Subtract 600×2=	1,200	
4.—Velocity of the 4th	8,900	8,828
Subtract 600	600	
5.—Velocity of the 5th	8,300	8,178
Subtract 600	600	
6.—Velocity of the 6th	6,700	7,636

I was led to discover the law of common difference of planetary velocities in the following manner: In 1857 I printed a small volume entitled "Geonomy, or the creation of the Continents." In writing an introduction to a proposed new edition of that work, I attempted to make a brief statement, and a plausible defense of the nebular hypothesis of Laplace. Being thus led to examine the subject critically, I convinced myself that the hypothesis is erroneous. I therefore endeavored to frame a more reasonable theory in its stead. After many unsuccessful experiments, I at length succeeded in producing the theory, that the relative magnitudes and densities of the planets are owing to the rotation of the nebula in a resisting medium; and that the rings were separated by the antagonism between the aggregating tendency and the differences of the orbital velocities. I gave the substance of this theory in a public lecture, in the winter of 1860, before the members of the Mercantile Library Association, in Boston. Shortly afterward, it occurred to my mind that if this theory is true, there should be some evidence of it found in the actual relative velocities of the known planets and satellites. I proceeded at once to construct tables of the orbital velocities, and was, of course, much gratified to find my theory confirmed in such a remarkable manner. A brief and imperfect statement of this discovery was published at the time, in the *Scientific American;* but I have not, until now,

been able to present the subject to the friends of science in a systematic form, and in connection with the serial relations of the square roots of the distances.

Definite Width of the Rings or Intervals, and the Laws of Their Increase with Distance from the Sun.

I have said that the rings must have been narrower the nearer they were to the sun. The reason is, that it requires less difference of the distances near the sun to obtain a given difference (1,582) of orbital velocities. This will be seen by inspecting the tables which represent the velocities and distances of the planets. The two known planets that differ most in orbital velocities, are those nearest to the sun and to each other, namely, Venus and Mercury; they differ in their velocities nearly 30,000 miles per hour, yet they differ in distances from the sun only 27 millions of miles. The two known planets that differ least in their velocities, are those most distant from the sun and from each other, namely, Neptune and Uranus; they differ in distance about 1,000 millions of miles, but in orbital velocities they differ only 3,160 miles per hour, which is nine times less than the difference between Venus and Mercury. Since the nearer bodies are to the sun the less difference of distances was required to obtain 1,582 difference in orbital velocities, it necessarily follows that the rings must have been wider the further they got from the sun.

Formation of Planets from Rings.

The nebula must have become divided into rings as soon as the sun was sufficiently large and attractive to establish orbital motions in the surrounding secondary matter. We have already seen reason to conclude that the resisting medium caused the nebulous matter to move interiorly by spiral paths toward the sun. This proceeding did not stop when the rings were formed; on the contrary, it was probably the means of forming rings into planets. A large mass of the lighter portions of nebulous matter, situated in the outer part of a ring, would be certain to move spirally to the inner edge; in doing this it would, of course, attract to itself nearly all the matter of the ring, and thus form a globular planet. Two masses, moving in the same orbit, at a great distance from each other, would never come together. But let one of the masses be composed of much lighter materials than the other, and the resisting medium would have a greater effect upon it, and

cause it to move in more open spirals, and thus enable it to get the inside track and overtake the other; or, at least, come so near to it as to attract it to itself and add it to its own mass. It was in this manner that I suppose that the rings were transformed into planets.

Formation of Asteroids.

We can readily understand how, on this hypothesis, many of the rings were prevented from becoming planets. If one of the rings were very massive, as in the case of that from which Jupiter was formed, its attraction would prevent the next interior ring or rings from undergoing the process already described as necessary to the formation of a planet: that is to say, the spiral inward movement of the light matter in the outer part of the ring, would be retarded, or entirely prevented, by the attraction of the massive exterior ring. This retardation would be the most likely to take place in the interior parts of the system, where the rings were very narrow. We know that there is a zone of asteroids, about one hundred millions of miles wide, in the interval between the orbits of Jupiter and Mars. According to the theory here advocated, there were originally fifteen rings in this interval. The attraction of Jupiter has rendered them all asteroids: that is to say, it has prevented the inward spiral movement which was necessary to form each of them into a normal planet; and thus it forced them to become aggregated into a greater number of planetettes, which are abnormally smaller and nearer each other. Is it not a strong presumptive proof of the truth of this theory that the regular planets are all solitary? In no instance do we find two moving in the same orbit, or the same zone; nor does any planet come near the orbit of another. If the rings had been *broken* up by any such accidents as the advocates of the nebular hypothesis commonly imagine, the inevitable consequence would have been that, in some instances, several planets, or fragments, would have the same or nearly the same orbit.

The following somewhat poetical account of the nebular hypothesis is from Nichol's Cyclopedia of the Physical Sciences:

"Has our reader walked in a mood of tranquil thought along the side of a quiet river, whose waving banks reflect a thousand currents, by the intermingling of which numerous dimples or whirlpools are produced—their easy course only marking the river's stillness? Has he followed these dimples as they pursue each other in gambol, and watched the phenomenon of the near ap-

proach of two or three? Then may he have witnessed the secret of the mystery of the double and triple stars! When one of these dimples approaches the vortex of another, the two begin *to revolve around each other;* and in fact they must on approximation, act upon each other as *two wheels;* so that a revolution of each around the other *must* immediately supervene, and increase in rapidity, until by external pressure they are forced into one. If such single neighboring nuclei were rotating, it would be precisely a case of two contiguous whirlpools; and *how could revolutionary motion be prevented?* Two such masses in approximate contact *must* originate such a motion: as the principle of gravity draws the nuclei nearer each other, the velocity of revolution must manifestly increase; and the two bodies would constitute themselves into a stable system when the rapidity of revolution sufficed to counterbalance their mutual attraction.

It is known to mechanics, that a grindstone may be made to revolve with a rapidity sufficient to cause splinters to fly from its rim, and even the whole rim to break in pieces—indicating that the centrifugal force of the rim with that velocity, more than counterbalances the mutual attraction or cohesion of the particles of the stone. Now if the rim, instead of being formed of brittle stone, had consisted of an elastic belt, say of caoutchouc, what would result in such a case? Clearly a separation of the rim from the mass of the rotating body; it would expand somewhat, just as the orbit of a planet in a similar position; and, if other circumstances permitted, it would revolve around the stone as a separate ring at a distance where the balance or equilibrium of the forces would be restored.

First—As the separation of the rings resulted from the centrifugal tendency of the particles composing them, and as this centrifugal tendency must always be greatest at the equatorial region of the rotatory mass, the rings must all lie *nearly in the plane of that equator*. Therefore, we are entitled to conclude, that into whatever forms or bodies these rings may ultimately be resolved, *these bodies must all lie in nearly one plane—the plane, viz., of the equator of the central globe.*

Secondly—The rings being *circular*—or, what is the same thing, the motion of each particle composing them being circular, the *orbits* or paths of whatever bodies are ultimately formed out of them, *must also be nearly circular.*

Thirdly—As the rings must continue to move as the nebula was

moving when they were abandoned, *the planets* into which they may be resolved *must all move in the same direction—that, viz., of the rotation of the central orb or sun.* Our subject is thus rapidly simplifying. We have already—even at this stage—deduced from this memorable hypothesis the necessity of the *principal three* of those fundamental arrangements which gravity could not explain. But let us proceed.

Resuming our direct investigation, we inquire now, what forms would such rings most probably ultimately assume? There are three possible forms: 1. The mass, if tolerably equable in its original constitution, and undisturbed from without, might settle down into a *rotating ring;* but the chances against such a result are so numerous, that we would expect the phenomenon to be very rare in the Universe. 2. If the mass broke up or separated while condensing—as its own internal irregularities would, in all probability, constrain it to do—it might divide into a number of portions so equal in attractive energy, that none of them would have any tendency to coalesce with, or fall into the others; so that the ring would ultimately be transformed into a number of distinct small solid bodies, revolving around the central mass at nearly the same distance from it. 3. Even this second supposition, however, is not a very probable one, inasmuch as its essential condition—the separation of the mass of the ring into *equally balanced* nuclei—could, in the nature of things, occur but rarely. By far the likeliest result is the division of the ring into nulcei of unequal power—the larger of which would, by its superior attraction, assume the others into its mass—the whole solidifying into one considerable globe."

According to our theory, asteroids would be certain to be formed in the interior parts of the system where the rings were narrow, and where an exterior ring or planet was very massive. If we examine the table, we shall see that fifteen rings have been rendered asteroidal by the powerful attraction of Jupiter exterior to them. If our reasoning may be relied upon, there are asteroids within fifty millions of miles of Jupiter's orbit, though none have yet been found within two hundred millions; there are also asteroids within ten millions of miles of the orbit of Mars, though none have been seen within fifty millions of miles. The same influence of Jupiter which prevented the known asteroids from becoming planets, came very near preventing the creation of Mars.

It has evidently prevented a large portion of the matter, that normally belonged to him, from reaching him. It has thus rendered him abnormally small and dense, besides depriving him of a moon, and nearly preventing him from inheriting even an atmosphere. It is difficult, now, to determine how much the attraction of Jupiter influenced the formation of the Earth; but, in conjunction with Mars, our theory indicates that it has rendered seven rings asteroidal between the orbits of Mars and of our planet. It also indicates that one of the primitive rings was within four millions of miles of the earth. Does not this agree with the observations which have been made in relation to the zodiacal light? Between the Earth and Venus seven rings existed, one of which was within three and a half millions of miles of the Earth's orbit. The large mass and the great density of Venus probably prevented that planet from being rendered asteroidal by the attraction of the Earth. The formation of a moon was actually prevented, in all probability, by the earth's influence, together with that of the nearest rings. Between Venus and Mercury are eighteen rings; nor is this surprising, when we consider that the rings in this interval were only from one to three millions of miles wide; and that Venus, a large exterior body, aided by the Earth, was opposed to their concentration. Of course, Mercury, under these circumstances, could not have a satellite. Between Mercury and the sun the rings became so rapidly narrowed, and so numerous, that normal planets were out of the question. We can now understand the reason of the greater space between the sun and Mercury than between Mercury and Venus, or between Venus and the earth. The same fact exists in Jupiter's system of satellites, and also in that of Saturn; the space between the primary and the nearest secondary is greater than between the first and second satellites. Our theory indicates that there were four primitive rings between the orbits of Jupiter and Saturn, which must have all been rendered asteroidal. Between Uranus and Saturn there were three rings, all of which *may* now exist in the form of planets, though as yet they are undiscovered. The influence of Saturn may possibly have prevented the ring nearest to his orbit from forming a planet; but I cannot doubt that the other two (denominated Apollo and Minerva in the tables) actually exist, and that they will yet be discovered in the orbits indicated in the tables. Between Uranus and Neptune there is probably another planet, Pluto,

whose velocity, 14,238 miles per hour, is a mean between that of Neptune, 14,238 miles, and that of Uranus, 15,730 miles per hour. The distance of Pluto from the sun is 2,230 millions of miles. Being 600 millions of miles from Neptune, and 400 from Uranus, it could not have been made asteroidal by their influences. If, therefore, a ring ever did exist in this interval, a planet is moving in it now.

Bode's Law of the Planetary Distances.

Kepler was the first astronomer who noticed the fact that the intervals between the planets become greater as we proceed outward from the centre. He also noticed that the interval between Jupiter and Mars, and also that between Venus and Mercury, was too great for the rule. He therefore suggested, or rather predicted, with the bold enthusiasm that characterized him, that a new planet would be discovered in each of those intervals.

Prof. Bode, of Berlin, has expressed the idea of the increasing intervals by a scheme of numbers, which is known as "*Bode's Law.*" It is as follows :

Mer.	Ven.	Earth.	Mars.	Ast.	Jup.	Sat.	Uran.	Nep.
4	4	4	4	4	4	4	4	4
0	3	6	12	24	48	96	192	384
4	7	10	16	28	52	100	196	388
3–9	7–3	10	15–2	27–4	52	95–4	192	300

The first line of figures is a repetition of 4; the second line begins with 0, then 3, next twice 3, then four times 3, and so on. The third line is obtained by adding the figures of the two upper lines together. The fourth or last line represents the actual distances of the planets from the sun.

Although Prof. Bode could give no reason for the law or relation of the distances which he and others had observed, we can now, by the light of the principles which have been explained in this essay, perceive that Bode's law has its *foundation* in nature. The primitive rings, or (which is the same thing) the planetary intervals, actually did increase in width by a regular law, though it was not identical with that of Bode. The real cause of the increase in the width of the rings with distance from the primary, was the rate of the decrease of the velocities. This rendered a greater difference of distance necessary to produce a ring in the outer part of the system than in the interior. Had

the decrease of the velocities been uniform, that is, so much for each mile, the rings would have been of a uniform width. *The increase in the width of the rings, therefore, was in the same ratio as the departure of the decrease of the velocities from uniformity.*

Imperfect as Bode's law is, astronomers have hitherto possessed no other means by which to judge, or even to conjecture, concerning the probable distances of undiscovered planets. When astronomers found that the perturbations of Uranus indicated the existence of an unknown planet, beyond the orbit of Uranus, they had no means whatever of guessing its distance, except the mere fact that from the earth to Uranus the intervals are about doubled. Leverrier and Adams, therefore, predicted that Neptune would be found about eight hundred millions of miles farther from the sun than he actually is. If the law of common difference of velocities had then been known, this mistake would not have been committed. It is a curious fact that our theory indicates that Hercules, the next planet (in the table) beyond the orbit of Neptune, is very nearly the same distance from the sun as Leverrier and Adams supposed Neptune to be. May it not be that the calculations of those two eminent astronomers were more correct than has been supposed, and that Hercules, and not Neptune, was the planet for which they were looking? Hansen, one of the ablest astronomers in Europe, declared, before Neptune was discovered, that the perturbations of Uranus indicated two disturbing unknown planets; our theory and tables indicate more than two. Some very distinguished mathematicians have expressed doubts whether the calculations of Leverrier really indicated the existence of Neptune; and are inclined to look upon its discovery by Dr. Galle as a fortunate accident. If this be true, it follows that the disturber or disturbers of Uranus, one or more, are yet to be found. Let us hope that the serial relations herein explained may contribute to their discovery.

Serial Relations of the Planets.

The velocity of Mercury, the planet nearest to the sun, is (according to Lardner,) 110,725 miles per hour, which is, of course, greater than the velocity of any other planet. If a series of rings originally existed that differed 1,582 miles per hour in their orbital velocities, it follows that each successive ring beyond Mercury had an orbital velocity of 1,582 less than its next

interior ring. If we call the orbital velocity of Mercury 110,740 miles per hour, and divide that number by 1,582, we obtain a quotient of 70 without any remainder. There could not, therefore, have been more than 70 rings, beyond and including Mercury; for the reason that beyond the 70th a difference of 1,582 could not be obtained. The outermost possible ring had an orbital velocity of just 1,582 miles per hour; the second ring just twice 1,582; the third thrice 1,585, and so on to Mercury, which must have a velocity of just 70 times 1,582—equal to 110,740. It is upon this principle that what I call the *serial relations* are founded.

In constructing the following tables, I have adopted 1,582 miles per hour as the common difference of orbital velocities, because I thus avoid the necessity of using fractions; though, perhaps, this number is not as near the truth as 1580. For the same reason I have assumed that 110,740 is the orbital velocity of mercury, instead of 110,725, which is probably more correct. These slight variations are, however, unessential.

Explanation of Table 6.

The first or left hand column of figures is a repetition of 1,582, the common difference. The second column contains a series of numbers from one to seventy, which I denominate the *serial numbers*, because they represent the series of rings; the most distant possible ring, or planet, (Chaos) being one. The third column contains the orbital velocities of the rings, or planets, obtained by multiplying 1582 successively by the several serial numbers. The fourth column contains the actual velocities, so placed that they can readily be compared with the theoretical numbers in the third column.

	Common difference. Miles per hour.		Serial numbers.		Theoretical velocities. Miles per hour.	Actual known velocities. Miles per hour.
Chaos	1,582	+	1	=	1,582	
Nox	1,582	"	2	"	3,164	
Cerberus	1,582	"	3	"	4,746	
Bacchus	1,582	"	4	"	6,328	
Janus	1,582	"	5	"	7,910	
Atlas	1,582	"	6	"	9,492	
Hercules	1,582	"	7	"	11,074	
Neptune	1,582	"	8	"	12,656	12,570
Pluto	1,582	"	9	"	14,238	

	Common Difference. Miles per hour.		Serial Numbers.		Theoretical Velocities. Miles per hour.	Actual known. Velocities. Miles per hour.
Uranus	1,582	"	10	"	15,820	15,730
Apollo	1,582	"	11	"	17,402	
Minerva	1,582	"	12	"	18,984	
Vulcan	1,582	"	13	"	20,566	
Saturn	1,582	"	14	"	22,148	22,306
Jupiter	1,582	"	19	"	30,058	30,203
Mars	1,582	"	35	"	55,370	55,812
Earth	1,582	"	43	"	68,026	68,890
Venus	1,582	"	51	"	80,682	81,000
Mercury	1,582	"	70	"	110,740	110,725

In table 6 it will be noticed I have made the serial number of Saturn 14, and that of Jupiter 19, thus omitting 4 serial numbers; the reason is that theory indicates that there were 4 rings of asteroids between the orbits of Saturn and Jupiter; though in this table I have omitted them to save space. So also the serial number of Jupiter is 19, and that of the next planet, Mars, is 35, because theory indicates that there were 15 rings between the two orbits. There were also 7 rings between Mars (35) and Earth (43); 7 rings between Earth (43) and Venus, (51); and 18 rings between Venus (51) and Mercury, (70).

I have taken the liberty to give names to the seven hypothetical planets beyond the orbit of Neptune, and to the four between the orbits of Neptune and Saturn, because it will render a reference to them more convenient.

Serial Relations of the Square Roots of the Mean Distances of the Planets from the Sun.

It is well known to astronomers that one of the consequences of the laws discovered by Kepler and Newton is, that *the mean orbid velocities of the planets are, one to another, inversely proportional to the square roots of their mean distances from the sun.*

This being the case, it follows, that if the orbital velocities of invisible planets or rings are ascertained by our theory of common difference of velocities, their mean distances can readily be ascertained by the rules of simple proportion. The following are illustrations of the application of this rule: The orbital velocity of the planet Mercury, in whole numbers of thousands of miles is 110. The orbital velocity of Mars is half as much. Upon ex-

amining the square roots of the distances of these two planets, we find the same proportion (though inverse) exists between them; that of Mars being 12 and that of Mercury 6, which is half as much; in other words, as 110 is to 55 so is 12 to 6. Again, the velocity of Uranus is 15,800 miles per hour, that of Mercury is 110,725, which is 7 times more; so also the square root of the distance of Mercury is 6 and that of Uranus 42, which is 7 times more. In the same way the mean velocities of any two planets in the series may be compared with the square roots of the distances of the same two planets, and found to be proportional.

This law of inverse proportion is of great practical value, in connection with our new theory; for, when the law of common difference of velocities indicates the existence of an undiscovered planet, the law of proportion enables us to determine its distance from the sun. For instance, in the space between Neptune and Uranus, the law of common difference of velocities indicates a planet, which, in the table, I have named Pluto, the velocity of which is 14,238 miles per hour. Now, as the calculated velocity of Pluto is to the known velocity of Mercury, so is the square root of the known distance of Mercury to the answer required; that is, to the unknown square root of the distance of Pluto.

One important result of this perfect proportion of the square roots to the orbital velocities, is that some of the same serial relations exist between the square roots that are found between the velocities. This is illustrated by the following table:

Explanation of Table 7.

The first, or left hand column of figures in table 7 is a repitition of 425, which is the square root of the mean distance of Chaos, the most distant possible planet in the series. This 435 is obtained by multiplying 6,071, the square root of 36,857,000 (the mean distance of Mercury,) by its serial number, 70. By successively dividing 425 by the serial numbers in the second column, we obtain the square roots of the distances of all the planets in the series, as they are represented in the third column. The fourth column contains the mean distances the planets from the sun, obtained by squaring the theoretical square roots in the third column. The fifth column contains the actual mean distances, so placed as to admit of easy comparison:

TABLE 7.

	Sq. root of the distance of Chaos.		Serial numbers used as divisors.		Square root of the distances.	Distances in millions of miles.	Actual distances in mil. of miles
Chaos	425	÷	1	=	425.	180,625	
Nox	425	"	2	"	212,5	45,156	
Cerberus	425	"	3	"	141.67	20,069	
Bacchus	425	"	4	"	106.25	11,289	
Janus	425	"	5	"	85.	7,225	
Atlas	425	"	6	"	70.83	5,018	
Hercules	425	"	7	"	60.71	3,686	
Neptune	425	"	8	"	53.125	2,822	2,854
Pluto	425	"	9	"	47.22	2,230	
Uranus	425	"	10	"	42.5	1,806	1,822
Apollo	425	"	11	"	38-64	1,493	
Minerva	425	"	12	"	35.41	1,254	
Vulcan	425	"	13	"	32.69	1,069	
Saturn	425	"	14	"	30.36	922	906
4 rings in this interval.							
Jupiter	425	"	19	"	22.37	500	494
15 rings in this interval.							
Mars	425	"	35	"	12.14	147	145
7 rings in this interval.							
Earth	425	"	43	"	9.88	98	95
7 rings in this interval.							
Venus	425	"	51	"	8.33	69	69
18 rings in this interval.							
Mercury	425	"	70	"	6.071	36,857	36,770

EXPLANATION OF TABLES 8 AND 9.

The law of proportion, and the serial relations, extend not only to the velocities and the square roots of the distances, but also to the intervals or differences between the square roots, and the differences between the velocities. This is illustrated in the two following tables, (8 and 9), which must be studied together as if they were one.

Table 8 gives the velocities of the planets, and their differences of velocities in serial order from Chaos to Saturn. The table might have been extended to Mercury, but the principle is sufficiently illustrated without occupying more space. It will be seen that if

we multiply the difference (1,582) between any two consecutive planets' velocities, by the greater serial number of the two, the product will be the greater velocity of the two. The reason is that the velocities and their differences are in a definite ratio to each other. 1,582 is one-half the velocity of Nox, and the same number (1,582) is one-third the velocity of Cerberus, and one-fourth that of Bacchus, and so on through the whole series. Now, when we examine the corresponding series of square roots of the distances in table 9, we and that the same ratio exists there: that is to say, if we multiply the difference between any two consecutive square roots by the greater serial number of the two, the product will be the greater square root of the distance of the two. The reason is as follows: the velocities and their differences, having a certain regular ratio to each other, the square roots of the distances and *their* differences (being in proportion to the velocities) have the same ratio to each other. Once more I remark that I wish the critical reader to bear in mind, that the design of these tables is, not to show how near the theoretical velocities or square roots agree with the actual, but to exhibit the remarkable *relations* which exist between the velocities and the square roots, arranged in what I conceive to be *their true serial order.* I also wish to furnish the most decisive proofs that the relations which I have pointed out are not mere coincidences, but are founded upon a *law* heretofore unknown.

TABLE 8.

	Velocities and common difference.		Serial numbers		Theoetical velocities. Miles p. hour	Known actual velocities Miles p. hour
Chaos	1,582	×	1	=	1,582	
Difference	1,582	"	2	"	3,164	
Nox	3,164					
Difference	1,582	"	3	"	4,746	
Cerberus	4,746					
Difference	1,582	"	4	"	6,328	
Bacchus	6,328					
Difference	1,582	"	5	"	7,910	
Janus	7,910					
Difference	1,582	"	6	"	9,492	
Atlas	9,492					

TABLE 8—Continued.

	Velocities & common difference.		Serial numbers.		Theoretical velocities. Miles p. hour	Known actual velocities Miles p. hour
Difference	1,582	×	7	=	11,074	
Hercules	11,074					
Difference	1,282	"	8	"	12,656	12,570
Neptune	12,656					
Difference	2,582	"	9	"	14,238	
Pluto	14,238					
Difference	1,582	"	10	"	15,820	15,730
Uranus	15,820					
Difference	1,582	"	11	"	17,402	
Apollo	17,402					
Difference	1,582	"	12	"	18,984	
Minerva	18,984					
Difference	1,582	"	13	"	20,566	
Vulcan	20,566					
Difference	1,582	"	14	"	22,148	22,306
Saturn	22,148					

TABLE 9.

	Square roots & intervals.		Serial numbers.		Square roots.
Chaos, square root	425.00				
Difference or interval	212.05	×	2	=	425.00
Nox, square root	212.05				
Interval	70.83	"	3	"	212.05
Cerebus, square root	141.67				
Interval	35.42	"	4	"	141.67
Bacchus, square root	106.25				
Interval	21.25	"	5	"	106.25
Janus, square root	85.00				
Interval	14.17	"	6	"	85.00
Atlas, square root	70.83				
Interval	10.12	"	7	"	70.83

TABLE 9—Continued.

	Sq. roots & intervals.		Serial numbers.		Square roots.
Hercules, square root	60.71				
Interval	7.585	×	8	=	60.71
Neptune, square root	53.125				
Interval	5.902	"	9	"	53.125
Pluto, square root	47.22				
Interval	4.72	"	10	"	47.22
Uranus, square root	42.05				
Interval	3.86	"	11	"	42.05
Apollo, square root	38.64				
Interval	3.22	"	12	"	38.64
Minerva, square root	35.41				
Interval	2.72	"	13	"	35.41
Vulcan, square root	32.69				
Interval	2.33	"	14	"	32.69
Saturn, square root	30.36				

If any doubts still linger in the mind of the reader, that this new theory is founded in nature, I think they must be entirely removed when he finds that the subordinate systems of Jupiter, Saturn and Uranus give their united testimony in its favor. Beyond all question, the same universal laws of the Creator by which the solar system was formed presided over the formation of every other planetary system in the boundless regions of space.

Jupiter's System.

Explanation of tables 10 *and* 11.

Proceeding in the same manner as we have with the solar system, we take the velocity of Io, the satellite nearest to Jupiter, which is 38,784 miles per hour, and divide it by what we suppose to be the common difference of the primitive orbital velocities, which is 808 miles per hour. We find the resulting quotient to be 48. We, therefore, infer that the most distant possible satellite or ring of this series has an orbital velocity of 808 miles per hour; and that the serial number of Io is 48, that of Europa 38, that of Ganymede is 30, and of Callisto 22. The first or left-hand column of figures in table 10, contains the common difference, 808,

repeated. The second column contains the serial numbers, by which the 808 is successively multiplied. The third column contains the resulting theoretical velocities; and the fourth column contains the actual velocities.

TABLE 10.

	Common difference.		Serial numbers.		Theoretical velocities. Miles p. h'r.	Actual velocities. Miles p. h'r.
Callisto	808	×	22	=	17,776	17,743
Ganymede	808	"	30	"	24,240	24,519
Europa	808	"	38	"	30,704	30,716
Io	808	"	48	"	38,784	38,772

SERIAL RELATIONS OF THE SQUARE ROOTS OF THE MEAN DISTANCES OF THE SATELLITES OF JUPITER.

The mean distance of Io, the nearest satellite to Jupiter, is 269,000 miles; the square root of this number is 518,651, which, if multiplied by the serial number (48), gives a product of 24,895.3, the square root of the most distant possible satellite of the series. If we divide 24,853 by the serial number of any satellite in the series, we obtain the square root of the mean distance of that satellite.

TABLE 11.

	Most distant square root of the series.		Serial numbers.		Square roots of distances.	Squares or theoretical distances.	Actual distances.
Callisto	24,895.3	÷	22	=	1,131.6045	1,280,529	1,152,000
Ganymede .	24,895.3	"	30	"	819.843	688,639	680,000
Europa	24,895.3	"	38	"	652.771	415,100	426,500
Io	24,895.3	"	48	"	518.651	169,000	269,000

The first, or left-hand column in table 11, contains 14,895.3 repeated. This number was obtained by multiplying 518.651, the square root of the distance of Io, the nearest of Jupiter's satellites, by its serial number, 48. The second column contains the serial numbers, by which 24 895.3 is successively divided to produce the square roots in the third column; the squares of which are the theoretical mean distances in the fourth column. The fifth column contains the actual mean distances.

SERIAL RELATIONS OF THE ORBITAL VELOCITIES OF SATURN'S SATELLITES.

Explanation of table 12.

Let us now examine the system of Saturn's satellites, and apply

the foregoing principles to them. The orbital velocity of Mimas, the satellite nearest to Saturn, is 34,986 miles per hour. This number, divided by 714, the common difference, gives a quotient of 49, which is therefore assumed as the serial number of Mimas. The most distant possible satellite of this series has a theoretical velocity of 714 miles per hour, which is the same as the common difference. Japetus, the most distant known satellite of Saturn, has 11 for his serial number, because his velocity is 11 times 714 miles per hour. The following table (12) will now be understood.

TABLE 12.

Names of known satellites.	Common difference.		Serial numbers.		Theoretical velocities. Miles per. hour.	Actual velocities. Miles p. hour.
	714	×	1	=	714	
	714	"	2	"	1,428	
	714	"	3	"	2,142	
	714	"	4	"	2,856	
	714	"	5	"	3,570	
	714	"	6	"	4,284	
	714	"	7	"	4,998	
	714	"	8	"	5,712	
	714	"	9	"	6,426	
	714	"	10	"	7,140	
Japetus	714	"	11	"	7,854	7,968
Hyperion	714	"	17	"	12,138	12,215
Titan	714	"	19	"	13,566	13,635
Rhea	714	"	29	"	20,706	20,776
Dione	714	"	34	"	24,276	24,516
Tethys	714	"	39	"	27,846	27,776
Enceladus	714	"	44	"	31,416	30,975
Mimas	714	"	49	"	34,986	34,986

SERIAL RELATIONS OF THE SQUARE ROOTS OF THE DISTANCES OF SATURN'S SATELLITES.

Explanaion of Table 13.

We will next examine table 13 of the square roots of the distances of Saturn's satellites. The mean distance of Mimas, the nearest satellite, is 126,000 miles. The square root of this number is 35.5, which, if multiplied by the serial number 49, gives a product of 1,740, which is the square root of the distance of the most distant possible satellite of this series. 1,740 being divided by

the serial number of any satellite of this series, gives, for a quotient, the square root of the mean distance of that satellite. The tables of Saturn's serial relations are interesting on account of the remarkable resemblance which they bear to those of the solar system.

Satellites' names.			Serial numbers.		Square roots of the mean distances.	Theoretical distances.	Actual k'n. distance.
	1,740	÷	1	=	1740.		
	1,740	"	2	"	870.		
	1,740	"	3	"	580.		
	1,740	"	4	"	435.		
	1,740	"	5	"	348.		
	1,740	"	6	"	290.		
	1,740	"	7	"	249.		
	1,740	"	8	"	217.		
	1,740	"	9	"	193.		
	1,740	"	10	"	174.		
Japetus......	1,740	"	11	"	158.	2,496,000	2,414,000
	1,740	"	12	"	145.		
	1.740	"	13	"	134.		
	1,740	"	14	"	124.		
	1,740	"	15	"	116.		
	1,740	"	16	"	109.		
Hyperion	1,740	"	17	"	102.	1,080,000	1,050,000
	1,740	"	18	"	97.		
Titan	1,740	"	19	"	91.5	837,000	800,000
Rhea	1,740	"	29	"	60.	360,000	358,000
Dione	1,740	"	34	"	51.	260,000	256,000
Tethys.......	1,740	"	30	"	44.6	200,000	200,000
Enceladus.....	1,740	"	44	"	39.5	156,000	161,000
Mimas	1,740	"	49	"	35.5	126,000	126,000

Serial Relations of the Satellites of Uranus.

Explanation of Table 14.

The satellites of Uranus are yet the subjects of discussion and doubt, and their elements are generally regarded by astronomers as unsettled. In contrasting table 14, I have put down four of the satellites according to Dr. Lardner. The two nearest satellites to the primary are not mentioned by him, and have been but lately discovered. I find their distances stated in Nichol's Cyclopedia of the Physical Sciences; and from this datum I have calcu-

lated their orbital velocities. The agreement of this series of six satellites with those derived from theory, is, under the circumstances, remarkable; and indicates that the observations of astronmers are not far wrong.

There are two other and more distant satellites in this system, the 7th and 8th from the primary (A. and B., which the elder Herschell announced that he saw through his telescope, and although he recorded their elements, no other astronomer has since been able to find them: it is consequently supposed that Herschell was mistaken. He puts down the velocities of these doubtful satellites, (See Lardner's Hand Book of Astronomy,) one as 3,816 miles per hour, and the other as 5,398 miles per hour. If the law of common difference may be relied upon, Herschell was certainly mistaken, either in his record or in his calculations. But it is possible that he was not mistaken in his *observations.* He may actually have *seen* both of them, but committed an error in regard to their positions. Applying the law of common difference, we find that these two satellites, if they exist, have, one a velocity of 4,036, (instead of 3,816), and the other 5,236, (instead of 5,392), miles per hour.

TABLE 14.

SATELLITES OF URANUS.

	Theoretical velocities. Miles per hour.	Actual velocities. Miles per hour.
Velocity of A, a doubtful satellite ----	4,036	3,816(?)
Add 600 + 2= ----------	1,200	
Velocity of B, a doubtful satellite ----	5,236	5,398(?)
Add 600 + 4= ----------	2,400	
Velocity of C, a known satellite ------	7,636	7,636
Add 600 ----------------	600	
Velocity of D, a known satellite ------	8,236	8,178
Add 600 ----------------	600	
Velocity of E, a known satellite ------	8,836	8,828
Add 600 + 2= ----------	1,200	

NOTE.—I have, in the above table, put down the actual velocity of A, as 3,816, and of B, 5,398, but I only mean that these are their actual velocities according to the calculations of Sir William Herschell, which are probably erroneous.

	Theoretical velocities. Miles per hour.	Actual velocities. Miles per hour.
Velocity of F, a known satellite......	10,036	10,056
Add 600 + 2=...........	1,200	
Velocity of G, a known satellite......	11,236	11,200
Add 600 + 2=...........	1,200	
Velocity of H, a known satellite......	12,436	12,500

If we compare the solar and the several statellitic systems with each other, we find that there are not only many points of resemblance, but also some particulars in which they are very different. It would seem that the system of Jupiter, of Saturn, of Uranus, and even of the Earth and her moon, were formed by the operation of the same general laws of nature which presided over the formation of the solar system. But the conditions and circumstances under which those laws acted, were different and peculiar in each system. After reflecting much upon the subject, I find that all the essential differences among the systems can be accounted for by supposing that the primitive nebulæ, from which they were formed, differed from each other in density, or in magnitude, or both. Suppose two nebulæ were at first exactly alike in every essential particular, except that one was twice as dense as the other. The rings formed in the more dense system would, according to theory, be just as numerous, as wide, and as near to the primary as in the less dense; but being twice as dense, they would possess twice as much attractive power. They would, therefore, perturb each other more, and cause a greater number of rings to become asteroidal; consequently, the intervals between the normal secondaries would be greater than in a less dense system.

Let us now compare Jupiter's statellites with those of Saturn. We may fairly presume that the present relative densities of the planets are a proper criterion of the relative densities of the primitive nebulæ from which they were formed. According to this rule the Saturnian nebulæ was the least dense. We can, therefore, understand why the statellites of Saturn are smaller, more numerous, and nearer to the sun and each other than those of Jupiter. The bright rings of Saturn have generally been regarded as anomalous and exceptional. I suspect, however, that there are similar rings in every system; but that in Saturn's system the matter of which the rings are composed has so little density, and therefore presents so large a surface for the reflection of light, that we can

see them: whereas, in all other cases the meteoric or asteroidal masses, though really arranged in rings, are invisible, because, instead of being aggregated as in Saturn's rings, they are formed into more widely separated bodies, so small and dense that they have not yet been discovered. What we call the zodiacal lights undoubtedly proceed from several rings of asteroids, which differ from those between Jupiter and Mars, principally, in being smaller and denser, so that they cannot be as easily seen. Some of the asteroids which theory indicates, between Saturn and Jupiter, are probably quite as large as Juno, and may yet be discovered. We can now perceive why Saturn's system, (included within the orbit of Japetus), is five millions of miles in diameter; while that of Jupiter, (included within the orbit of Callisto), is only three millions. If the Saturnian system had shrunk so as to be twice its present density, it would doubtless have occupied less space than Jupiter's system does.

The rings of the Jovian nebula were more dense and attractive than those of the Saturnian; and therefore purturbed one another to such a degree that a large number were prevented from becoming statellites, consequently the intervals between those that were formed are very wide.

One of the consequences of our theory is that the greater the mass of a primary, the narrower the secondary rings were at a given distance from the primary; for the larger the primary the greater must be the orbital velocities of the secondaries at given distances; and, of course, the narrower must have been the rings. At the distance of one million of miles from Jupiter, the primitive statellitic rings were much wider than those formed in the solar system one million miles from the sun. Saturn's rings, at the same distance, were still wider; and the rings of our own terrestial system, from the principal of which our moon was formed, was the widest of all, when the distance from the primary is considered.

Now let us compare two systems that are alike in everything, except that in one the primary is many times the more massive. What difference would that make in the secondaries? The larger the primary the greater, all else equal, must be the orbital velocities of the secondaries, and, consequently, the narrower the rings formed within a given distance of the centre. The narrower the rings the more they must have perturbed each other, and tended to produce asteroids. This is the reason why the interval between the primary and the first secondary is greater the larger the pri-

mary is, provided the densities are equal. Jupiter is both denser and larger than Saturn; so that there are, in this case, two reasons why the interval should be greater between Jupiter and Io than between Saturn and Mimas.

The deductions from the foregoing are:

1. The hypothesis of Laplace, that increasing centrifugal force threw the exterior rim of the nebula off, is inconsistent with the fact that 667 parts out of 668 are now in the sun; and 439 out of 475 parts of the remainder are now in the interior third of the radius of the system, while only 36 parts are in the outer two-thirds.

2. The nebulous mass in rotation would tend to become an oblate spheroid; and the most of its matter would be located between the Sun and Jupiter, where there actually is the least matter.

3. The effect of a resisting etherial medium would be to cause the lightest portion of the nebulous matter to move in spiral paths to the Sun. The matter nearest to the Sun, the orbital motion of which was greatest, would be most affected by the medium. The densities of the planets, and the actual distribution of matter in the solar system, and in each system of satellites, is such as this theory requires. In each system there is, first, an immense primary; second, several small secondaries with narrow intervals, the first interval, however, being greater than the next succeeding one; third, there is one giant secondary, containing more matter than all the others; fourth, beyond the giant are one or more secondaries of intermediate size, with very wide intervals.

4. It was long ago noticed that the intervals between the planets and satellites become greater the further they are from the centre, and this fact is represented by what is called Bode's law; but no reason for the fact has, until now, been discovered. I have found that the differences between the orbital velocities of the secondaries, in each system, can be divided by a common divisor without any essential remainder. The divisor in the case of the planets is 1,582; of Jupiter's satellites, 808; of Saturn's satellites, 714; of the satellites of Uranus, 600. I account for this fact on the theory that the parts of the nebula were held together by an attractive force, which, in the solar system, it required a difference of orbital velocities equal to 1,582 miles per hour to overcome. On account of the increasing velocities, this difference was obtained with less difference of distance (a narrower interval) the nearer the matter

was to the centre; consequently the rings decreased in width in the same ratio as the velocities increased; and the primitive rings had a common difference of velocities equal to 1,582 miles per hour.

5. The movement of the nebulous matter in spiral paths toward the centre, caused a large portion to accumulate at the inner edge of each ring in a globular mass; and thus the rings became transformed to planets.

6. In the interior parts of each system the rings were extremely narrow, and the attraction of the exterior rings prevented the inward spiral movement requisite to form normal planets; consequently, rings of asteroids or planetettes were produced between all the interior secondaries.

7. In the outer parts of the system, where the rings were very wide, and the planets not very large, no asteroids were formed; therefore I infer the existence of a planet (Pluto) between Neptune and Uranus, and several others between Uranus and Saturn. I also infer the existence of several undiscovered satellites in Saturn's system.

8. The orbital velocities of unseen planets being ascertained by the theory of common difference, their distances can also be determined, by the rule that the orbital velocities, one to another, are inversely proportional to the square roots of the mean distances.

9. In carrying this new theory out to its consequences, an interesting relation has been discovered between the square roots of the distances, which has never before been known, and which is illustrated by several tables.

10. The more massive a primary, the narrower at a given distance must have been the primitive rings or intervals, and therefore more likely to purturb each other, and produce asteroids.

11. The less dense the nebula from which rings were formed, the less massive the rings must have been, and therefore less likely to produce asteroids by their mutual perturbations.

12. The reason why Saturn's satellites are, some of them, so near the primary, is because the primitive Saturnian nebula had so little density. The same fact accounts for the narrow intervals between Saturn's interior satellites.

At the conclusion of Mr. Grimes' exposition, an animated discussion arose, in which Drs. Vanderweyde and Bradley, Messrs. Miller, Walling and others took part. It was the general opinion of those who adopt Laplace's theory that Mr. Grimes had not

made himself fully intelligible on the many interesting points touched on in his discourse. In the course of the discussion an expression bordering upon irreverence drew from the chairman the following remarks:

The chair deeply regrets that a single expression has been used in the heat of debate which might be construed to imply disrespect to the Deity. The tendency of all profound study of heavenly bodies is to elevate our conceptions of the Great First Cause. The revelations of science confirm more strongly our belief in a Creator having infinite attributes. Modern investigations prove that the countless stars or suns are parts of one grand system, guided and governed by the same fiat. Research has shown that the known portion of the Universe is pervaded by a subtle etherial medium in which all celestial bodies are immersed, and through which an ubiquitous power is incessantly exerted; and further, the elasticity of this medium of light, heat and actinism compels us to the conclusion, that within it there is a still more attenuated agency, reaching to the confines of the spiritual, and through which the Creator may communicate with his intelligent offspring. Push our material conceptions as far as we can, there is still a void which can only be filled by the Divine afflatus that animates creation. From the fields of mere speculation, we are compelled to return with the exclamation "His ways are past finding out." Science can only definitely testify to the presence throughout the the Universe of a unity of power and design—that power being the Divine energy, and that design a direct emanation from the Deity.

Adjourned.

AMERICAN INSTITUTE POLYTECHNIC ASSOCIATION, *January* 17, 1867.

Prof. S. D. Tillman in the chair; T. D. Stetson, Esq. Secretary.

The Chairman presented the following report on new discoveries and inventions:

BELLADONNA.

The London Hospital reports, recently published, contain accounts of two cases of poisoning produced by the external application of belladonna preparations.

METEORIC STONES.

Leichenback calculates that on an average at least twelve meteoric bodies fall daily upon the earth's surface, so that in 1,000 years

upward of 4,000,000 of these bodies must have been added to the earth's mass.

Heat from the Combustion of Hydrogen.

M. Schlœsing passed hydrogen gas, obtained from the decomposition of water, over incandescent charcoal, and on to the place of combustion, where it received the necessary oxygen from the air—both the hydrogen and the air being regulated in supply—and thus produced the temperature of 2,700° C. or 5,198° Fahr.

Effects of the Spark.

M. Lewis has found by a series of experiments and observations with the microscope that the electric spark, however produced, makes pentagon perforations. He has experimented with chemically prepared paper, the leaves of plants, mica, thin glass, film of egg, &c., and invariably finds a five-sided hole.

Defective Leather.

The sticky or gummy condition of some of the cheaper kinds of curried leather, and its liability to crack, is said to be owing to the use of fish oil in the finishing. Neat's-foot oil being the product of the bovine species, seems to be naturally adapted to the tanned skin, and the evils alluded to have only appeared where other oils have been substituted by the currier.

On the Blue Coloration of certain Glasses and Slags.

M. J. Fournet, in a note to the French Academy, concludes that this effect is the pure and simple result of molecular grouping, of which opacity—that is to say white enamel—is the final product. By polishing pieces of blue bottle glass, varying in thickness, a decided dichroism is observed—blue by reflection and orange by transparency. Generalizing the result of these observations, the author shows that this dichroism belongs to many substances met with in nature; corundum, phosphate of iron, pure water, and clouds all show it under certain circumstances. The author does not concur with the opinions of MM. Méne and Chevreul, which we have recently recorded.

New Mode of Moving Canal-Boats.

An experiment has lately been tried on the Erie canal, near Buffalo, which is said to have been quite successful. A wire rope is laid on the bottom of the canal. By means of what is called a

clipped-drum, driven by a steam-engine on the boat, the rope is raised and the boat is drawn underneath the rope. The peculiarity of the clipped drum is a combination of toggle-joints on its periphery, so arranged that the rope in passing over these joints is pinched with such force as to draw the boat onward. By the revolution of the drum the joint passes beyond the rope and again opens by its own gravity; it thus acts like a series of hands grasping, one after the other, the same rope. The advantage of this arrangement is that the whole power is applied to the propulsion of the boat without the loss by slip which occurs when the paddle-wheel or propeller is applied to water. Only one rope is required, for when two boats moving in opposite directions meet, one boat is released from the rope until the other passes, when the rope is again grasped.

The Solar Focus as a Medical Agent.

Mr. Augustus Barnes, of Connecticut, has discovered that the solar focus is a most efficient and admirable caustic. He uses a lens of two or three inches in diameter and pushes the condensed rays over the whole object, to be removed, if not more than two or three inches in diameter, at one sitting. The rays are applied to a very minute point, and changed at each instant, so that the pain is less than might be apprehended. Patients submit to it very readily, without the use of anæsthetics. Dr. Pinkney W. Ellsworth, of Hartford, describes in *The Medical and Surgical Reporter* the application of the new remedy to a gentleman who had a nævus on the face, extending from the eye to below the mouth, and covering four or five square inches of surface. The rays were condensed with excellent success, even on the very edge of the lower lid of the eye. After two applications, the deep cherry-red color of the skin, and knobs of condensed tissue, an eighth of an inch high, had nearly disappeared; some portions being absolutely like normal skin. Lupus, icthyosis and small tumors have been subjected to this process with promising results.

How to Prepare Coffee.

From Liebig's researches it appears that the oxygen of the air influences the liquid coffee made by pouring boiling water on the roasted and ground berry, so that, although excellent at first, it soon becomes unfit to drink. To obtain the best results Liebig recommends that the good grains of coffee be picked out of a heap

one by one. They should be washed in order to see whether the grains have been artificially colored or not, and then dried in a towel. The operation of roasting should be performed with great care, and not cease until the grains have lost their horny texture and admit of being crushed between the fingers. Caffeine, the active principle of the berry, would be decomposed if the roasting process were not conducted slowly, and stopped on attaining a light brown hue. A dark brown color, or worse still a black, would show that the berry had lost all its virtues. In order to prevent the air from acting injuriously on the coffee after roasting, sugar should be sprinkled over it in the proportion of fifteen grammes to every pound, and the whole should be well stirred. In this way an impenetrable coating of caramel protects each grain. After roasting the berries should be placed on iron plates and left to cool in a dry place. No more coffee should be roasted at a time than is required for the day. The roasting should not be done in a closed cylinder, as is the common practice, but in a frying pan, so as to be able to watch the various changes of color.

Graphite.

This form of carbon commonly called black lead or plumbago occurs, mechanically mixed with a small proportion of iron, in granite, gneiss, mica-slate, primitive limestone and greenstone. Its principal use in the arts is in the manufacture of pencils and crucibles. It is found in many places in this country, but is seldom of the first quality. The best graphite in our market is brought from Ceylon. Graphite can be formed artificially by subjecting iron, in contact with carbonaceous matter, to a very high temperature. It may separate in the crucible in which the experiment is made or may penetrate the iron itself. By treating gray cast-iron with hydro-chloric acid and other re-agents carbon is separated in crystalized six-sided tables In iron furnaces graphite is artificially formed on a large scale. Professor Playfair, before the British Association, recently spoke of a furnace at the Alfreton Iron Works, which was forty or fifty years old, or about ten times the average age of a furnace. It was recently repaired, and he had then opportunity of ascertaining why it lasted so long. He found it lined with graphite three or four inches thick, not by the manufacturer but by the operations of nature. The carbon in the iron had been squeezed out, and the whole furnace was probably lined with graphite.

A Substitute for Collodion.

M. Persoz, jr., has recently devised a method for obtaining a material possessing the same characteristic qualities as collodion. The new substance is produced by dissolving silk in a suitable solvent, and then separating the latter by means of dyalysis. If the film be of a certain degree of thickness it assumes, on dyeing, a golden tint, but this, no doubt, would scarcely be perceptible in a thin film, such as would be used in photography. The salt preferred by Persoz is chloride of zinc, which, when kept at a warm temperature, readily dissolves the silk, but if not warmed the silk takes much longer time to dissolve. Before employing the chloride of zinc, it is heated with a small quantity of the chloride of zinc in order to neutralize any excess of acid in the chloride, and then filtered through a piece of fine cambric to remove the superabundant oxyd. To separate the chloride of zinc from the solution of silk M. Persoz uses an apparatus for dyalysis which is a kind of seive, made by means of a broad strip of gutta-percha bent round and cemented in the form of a cylinder, at one end of which is a disc of parchment to form the bottom. The apparatus is floated upon a vessel of water, and the silk solution, previously diluted with water to the consistency of collodion, is poured into it. The chloride of zinc percolates through the moistened disc of parchment, and mixes with the water in which the apparatus is floating. In a few days the whole of the chloride of zinc will be found to have separated from the silk solution, but the presence of a slight quantity of the chloride of zinc in the material is of no great consequence, as it merely gives rise to the formation, in the *sensitive film*, of a minute quantity of the chloride of silver. Doubtless a dry film of of this substance would be quite insoluble in water. Its employment in photography is very simple. It is first iodized by mixing with it an aqueous solution of iodide, and then dried and sensitized. The exposure and the development of the picture are conducted in the same manner as when ordinary collodion is used.

Ozone.

Dr. Daubeny, in a paper lately read before the London Chemical Society, has given the results of an extensive series of experiments and meteorological observations made at Torquay and Oxford. After describing the tests employed to indicate the presence of ozone and showing that the indications during the winter months clearly pointed to the influence of the sea in augmenting

the amount of ozone at Torquay, he recounted the results of an examination of the air exhaled by growing plants. Dr. Daubeny found, in thirty-two instances out of fifty-seven plants experimented upon; sensibly larger amounts of ozone in such air than in the surrounding atmosphere, and he was therefore led to the conclusion that the generation of ozone in the process of vegetation was one of the appointed means of nature for the purification of the air, and that not only were plants useful in restoring the equilibrium of the atmosphere, but that they took an active part in the destruction of pernicious organic compounds given off either in the process of decay, or by the waste of animal organisms. More ozone was found near the sea than at inland localities ; a greater amount in the country than in the towns ; and, lastly, more outside of a building than in its inhabited rooms. The outbreak of epidemics was often ascribed to the deficiency of ozone in the atmosphere, but he had no evidence on that point. The action of hydrocarbons—which, by uniting with oxygen, furnish indications of ozone—had in his experiments been guarded against by removing the test-paper to a greater distance, in the case of plants exhaling aromatic odors, some of which had been examined, he had also found it necessary to discard altogether the use of India rubber tubes for connecting the parts of the apparatus, since it quickly destroyed every trace of ozone. After the reading of Dr. Daubeny's paper, Dr. Gilbert referred to other statements made in relation to the generation of ozone by vegetation, and expressed the opinion that further evidence was required to establish the identity of the ozone-like emanations of growing plants, and the odorous substance produced during the slow combustion of phosphorus in moist air.

After the reading of these items, an interesting discussion took place on the first item, relative to action of belladonna when externally applied. Dr. Vanderweyde explained its action when taken internally, and its peculiar effect upon the pupil of the eye. He said it was sometimes used by ladies to produce brilliancy of the eyes. Drs. Stevens, Bradley, Feuchtwanger, Richards, Halleck, Messrs. Bartlett, Reid and Maynard took part in the discussion. It was generally conceded that belladonna, like opium, tobacco and other strong narcotics, when externally applied in large quantities, was poisonous.

The item on graphite also brought out considerable discussion as to its origin, and the quality of that found on this continent.

New Boiler.

Mr. J. Wyatt Reid explained, with the aid of diagrams on the blackboard, his new upright boiler. He increased the heating surface by means of side pipes or flues, through which the smoke ascended.

Mr. W. Lee thought it would be more efficient with shorter tubes.

Mr. Joseph E. Miller remarked that there was more danger of the crown sheet being overheated in this arrangement

Chemical Analysis by the Spectrum.

Dr. Vanderweyde exhibited a spectroscope and explained its use. It is well known, he said, that flames of various colors are produced by metallic compounds. When these flames are burned before a narrow aperture, and the ray of light passing through it is decomposed by a prism, spectra are produced which exhibit different colored bands of light. When spectra of metals are examined, it is found that their flames give colors peculiar to each metal. If five or six salts are mixed together and put into a flame, the presence of the minutest quantity of each can be recognized. By ordinary chemical processes, it would require several hours hard work to detect the presence of these bodies, but with the aid of the spectrum this result may be arrived at in half a minute. Cæsium, a new metal, was discovered in a mineral water, where it existed in so small a quantity that several tons were evaporated to obtain one hundred grains of the metal. The constitution of the sun's atmosphere has been found out, partially, by this method, and it is impossible to foresee to what extent it may be used.

Dr. L. Bradley read the following paper on

Cosmogony.

The hypothesis of Laplace assumes that the solar system was once a nebula. How was it brought into this state ?

By the patient and indefatigable researches of Herschell, Struve, Peters, Maedler and others, we are invested with the knowledge that the sun, in company with the innumerable other masses of the *milky way*, are all in motion, and that they are all moving in nearly the same direction.

Combining the profound researches of Argelander, Struve and Peters, we are now able to pronounce the following wonderful results :

The sun, attended by his planets, satellites and comets, is sweeping through space towards the star *Pi*, in the constellation of *Hercules*, with a velocity of 33,550,000 miles per annum.

It is further demonstrated that we are all in the course of a great astral revolution, the centre of which M. Maedler has shown to be in the bright star *Alcyon*, near the centre of the beautiful little cluster, the *Pleiades*. This fact has been confirmed by others.

To give some idea of the vastness of the scale on which this great structure is erected, I will give a few figures.

The star *Pi*, in Hercules, is at such a distance from us, that its light in coming at the rate of 12,000,000 miles per minute, requires forty-six years. It will take then 1,800,000 years to reach the point in space where that star now resides.

Light to come from *Alcyon* at the great astral center, requires 537 years=47,041,200 minutes. This multiplied by 12,000,000, the distance which light travels per minute, gives 564,494,400,-000,000 of miles, and this divided by 33,554,000, the distance passed over by the sun in a year, gives 16,825,585,000,000 of years for the sun to move that distance; and this is only the length of the radius vector of the great astral orbit of the sun, which we may multiply by six for the time required to perform a single revolution, which is 100,953,522,000,000 of years. Should it be demonstrated, however, that this great orbit is a very eccentric one, and that the sun is now in aphelion, or more properly *aphalcyon*, and moving at a slow rate of speed, then the estimated time of revolution would be much reduced—say to 30,000,000,-000,000 years. Even these figures are enough to astound the immagination. But we must lay aside our childish modes of thinking and learn to view nature as she is, in both the *infinite* and the infinitesimal. How strongly the foregoing figures contrast with the following. In bringing the microscope to our aid, it is said, that a single grain of the polishing powder *tripoli*, present to our astonished view 2,000,000 of the skeletons of once living beings—and that the spider's webb, of which it would take 36,000 to make the thickness of a thread of common sewing silk, is composed of 6,000 finer filaments which were secreted by 6,000 perfect glands.

I ask now, would it not be reasonable to suppose that the sun might, somewhere in the course of his great astral round, find himself in a region of cold, *a great astral winter*, where all would be chilled and congealed, and then, in the course of a few billions of years, might reach a climate more mild,—*a great astral summer*,

in which a temperature, many degrees higher than that required here to gasify all matter, might be found, and where all would again be restored into *nebula ?*

Is not this in harmony with nature's laws as we see them displayed everywhere?

In an essay on heat, Grove says: "It is quite conceivable that the whole solar system may pass through portions of space, having different temperatures, as was suggested, I believe by Poisson; that, as we have a terrestrial summer and winter, so there may be a solar or systematic summer and winter, in which case the heat lost during the latter period might be restored during the former."

This summer having resolved our sun and his attendant planets, satallites, and comets into a *nebula*, let us trace the operation of laws by which he would be restored to his present condition and place.

To be rational, an hypothesis in *physical* science can admit nothing supernatural, in the common acceptation of that term. All the phenomena pertaining to it must be in harmony with and obedient to Nature's Laws—the laws of the Great First Cause—God.

What would be the course of phenomena under laws well understood?

Let us suppose our solar nebula to be some 10,000,000,000 of miles in diameter, (this was probably not more than the truth, for the orbit of Neptune is nearly 7,000,000,000 of miles)—balanced in space, having no object within many millions of miles to distract it. It would be reasonable to infer that it has carried with it some of the impulses of rotation under which we see it moving now. But to illustrate the point intended to be made, we will imagine it to be just at the point of maximum heat, where the contracting force of gravitation and the expansive force of heat are balanced. We may now suppose its mass in itself to be in a state of quiescence; the heat which it radiates and that which it receives are equal—it is neither expanding or contracting. But such a state can continue only for an instant. The mass moving in its orbit, is passing into a colder region, and radiates faster than it receives. Gravitation is free to act—the mass is contracting and falling toward a common center.

What may we now expect to see? What *do* we see when fluid, either elastic, or non-elastic is gathering toward a common center? What do we see in the common funnel when we fill it with liquid and let the liquid flow through it? Rotation: Not necessarily so,

but the chances are vastly in favor of rotation, and when once commenced rotation increases with accelerating force.

The effect of rotation is to incline matter to separate, and go off in a tangential direction, as we see the particles flying off from the rapidly rotating wheel; but gravitation restrains this tangential tendency, and holds the matter to its rotation, and the force becomes only a centrifugal force, counteracting and opposing the centrifugal force of gravitation. The centrifugal force increasing, an equatorial belt swells out, the poles depress, and the mass becomes an oblate sphere.

Condensation from cooling now supervenes, and renders the exterior equatorial matter less mobile, or more viscid; and this, also, tends to counteract gravitation, and the specific gravity being increased, centrifugal force is still more increased; and finally, in a portion of the equatorial protruding belt, the centripetal and centrifugal forces become *equal*, and being thus equal and perfectly balanced, it ceases to fall, and stops in the form of a ring; but its revolving tendency is not interrupted.

The interior mass being relieved from its exterior incumbrance is more volatile, and goes on falling as before, until, in obedience to the same laws, another ring detaches itself, then another, and another, till the sun has finally settled down to its present dimensions of 883,000 miles diameter.

Returning to the first ring, we find that it has been gradually, but constantly, radiating its heat and contracting, and that on one side, from some unknown cause, it had separated, and the annular mass, under the influence of its own interior gravitation, had, without the least shock or disturbance, gathered itself together in its grand orbit, in which it is still moving with the same velocity and at the same distance from the prime centre, as when it first separated.

The same laws were operative in the separation and formation of satellites as of primaries.

An interesting fact in support of this theory is that two of the offshoots from Saturn still maintain their status as rings, no defect in their integrity having admitted of rupture.

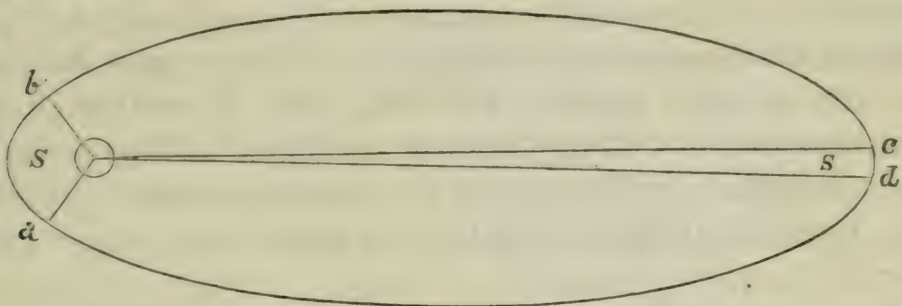
After Jupiter had been segregated, it seems reasonable to suppose that the remaining primary mass might have been in some way unusually perturbed, so that the succeeding ring had many weak points, admitting of its breaking and forming many asteroids.

The mode of cometary segregation is different from that we have been considering.

The tangential force, aided by heat, being the principal agent, which, modified by gravitation, gives the comets their extended and extremely elliptical orbits.

Cometary matter may have been thrown off, either from the prime solar mass, the primaries, the secondaries, or even from comets themselves.

The orbits of all the planets are elliptical, and those of the comets exceedingly so. The sun is always in one of the foci of the orbit, and the movement, when in *perehelion*, is more rapid than when in *aphelion.*



According to Kepler, the radius vector of an orbit describes equal areas in equal times. If we suppose the areas of *s* and *s* to be equal, the body will move from *a* to *b* in the same time as from *c* to *d*. (See figure.) One comet has been observed to occupy but two hours in passing from *node* to *node*, a distance of 1,500,000.000 of miles. With so rapid a movement and so quick a curve as that, would not a portion of matter be very likely to go off upon a tangent? Is it not possible that a small comet performing its round every 33 years gives off a little spray at every perihelion passage, thus furnishing us with those beautiful meteoric displays from time to time, of which so much has been said and written?

One objection brought against the *nebular theory* is that it fails to account for the eccentric course of Uranus and Neptune, also movements of the moons of Uranus. These may be accounted for, however, by the supposition that the prime nebular mass was not a round and perfect sphere, but was irregular in its contour; an eccentric and irregular ovoid. The same cause may be assigned for the apparent irregularities, as well as for the eccentricity of all the planetary orbs.

That finite minds cannot wholly comprehend the *modus operandi* of some heavenly bodies is no reason for rejecting a theory, which

accounts so beautifully for so many of the celestial phenomena, and still cling to old hypotheses, which account for nothing without doing violence to the principles of modern science. Wiser heads may yet, and very soon, account rationally for what to us now seems mysterious.

The admirable doctrine of correlation, conservation and conversion of forces must not be overlooked, and ours is the only theory that can harmonize with it and carry us back to a consistent beginning of the present order. Some better and more rational theory than has ever yet been sought out must be offered before we can yield up this.

We find strong support in the remarkable relation which exists in the times, distances and movements of the planets; showing a complete family connection among them. The distances have been set forth in other papers. For the times of rotation Kepler demonstrated that "The squares of the times of the revolutions are, to each other, as the cubes of their mean distances." It would seem by this that Mercury is the last planet that can be thrown off.

Let us now direct our attention to the sun and his sources of heat. Condensation always developes heat. The falling together of matter produces heat. The matter of our solar system which has not gone to form planets, satellites, comets or meteorites, has fallen into the domain of the sun ; and the matter which has fallen, as well as that upon which it has fallen, has become heated by the concussion and pressure. But these are not the only sources of heat to the sun. As the molecules of matter have approached each other, they have slowly and gradually come within the sphere of chemical attraction, whose action, in combining chemically the elements of matter, is by far the greatest source of free heat of any and all others combined. This fact may be illustrated many ways. Witness the burning of gas, and in combustion of all kinds. Observe the combination of oxygen with a metal, for instance, on heating these few grains of Magnesium. It is one of the lightest metals, yet its chemical relations are such as to develop intense light and heat in burning. In this we have true solar light and heat, which has been carefully conserved, stored up and handed down to us for our amusement and instruction this evening. It was once a part of the sun ; it is now an integral of the earth, and the earth was once an integral of the sun. It was a favorite idea of Mr. George Stephenson that the light which we nightly obtain

from burning coal, or other fuel, was a reproduction of that which had, at one time, been absorbed by vegetable structures from the sun.

Under the operation of the laws and forces before mentioned, the sun has become, as we see him, a molten mass of incandescent matter, glowing with intense *light* and *heat*.

On examining the sun with a telescope, we discover that his disc is not uniformly bright. There are scattered upon it, small dark spots, which are in a state of continual change, and again there are large black spots, surrounded by penumbra, which are gradually shaded down from the black central part to the white light. They change from day to day, and even from hour to hour. They break up or contract, and finally disappear. They show all the signs of mobility, characteristic of masses floating in molten liquid, and of melting and passing away. The spots are confined to a zone extending 30° each side of the equator, and they seldom continue longer than five or six weeks. They appear to occupy deep cavities in an incandescent gaseous, or semi-gaseous envelope, or covering of a molten sea, and their penumbra indicate what we might expect from currents, converging and flowing in from the hot gaseous atmosphere over the dark cavity.

There are sometimes seen, peculiarly marked lines, brighter than other parts of the surface which are curved, or deviate in branches. These are apparently immense waves on the solar sea, and seem to give evidence of disturbing causes there, as well as here producing winds, waves, currents, etc., only on a much larger scale.

Many fanciful notions have been broached on this subject. One is that these spots are the dark solid body of the sun itself, laid bare to our view through openings in its luminous atmosphere. Laland suggests that eminences in the nature of mountains are laid bare and project above the luminous ocean; appearing black above it. How he supposed these cold mountains got covered again in the course of five or six weeks we are left to conjecture.

This hypothesis of a cold sun with a luminous atmosphere is quite in keeping with that other hypothesis, which is based on the assumption of a cold opaque sun, invested with a luminous or phosphorescent atmosphere, whose rays, in passing through our atmosphere, become heated by friction.

All such notions of a cold sun, and of cold sun-beams, bring in to us no other genial heat than what they get by friction in our

atmosphere, are, in my estimation quite too chilling. To credit them would be to prostrate the beautiful doctrines of conservation of force in the undulation of *ether*, so well taught by modern science and so generally received by modern philosophers. Where could be stored the force necessary to endow an imponderable ray with the genial and vivifying heat of the sun-beam? Not in the atmosphere; certainly not in the ray.

It will not be out of place here to suggest an hypothesis in regard to the sun spots.

When earthy matter in a molten state, cools by radiation and crystalizes, it is lighter than the molten mass and floats upon it; but when the crystaline mass cools, it contracts, becomes heavier and tends to sink. After contemplating the peculiar appearances, motions and evolutions of the sun's spots, may we not conclude it is possible, nay, probable, that they are the manifestation of an effort, on the part of nature, under the operation of well known laws, at solar incrustation?

May not a mass commencing to crystalize, extend its borders and increase upon its under surface; the upper portion at the same time cooling more and more, until the increasing specific gravity, aided by the buffetings of waves and currents, causes it to be submerged and to melt and disappear?

If the sun is approaching a great astral winter, as has been suggested, it seems reasonable to suppose that the spots will increase, and that in less perhaps than a million of years they may so accumulate, as finally to coalesce and form a solid crust, like that of our earth. Then the "God of day" will cease to shine and be counted among the lost stars.

Dr. P. H. Vanderweyde read the following paper,

On the Instability and Transitory Condition of the Planetary System.

With all due respect to the great men who were our teachers in the science of Cosmogony, at the head of which stand Newton and Laplace, we need not necessarily adopt all the conclusions they arrived at, as those conclusions were founded merely on the facts known at the time they lived. At present our knowledge is increasing in a ratio never known before, and, as is always the case, chiefly in a direction in which we did not expect to progress so immensely. New facts are accumulating all around us, we commence to invent and discover the art of making inventions and

discoveries, and we must not be surprised when we receive an avalanche of discoveries and inventions in all parts of arts and sciences. We may truly say that great revelations are dawning, and that the old saying "thus far shalt thou go, and no farther" has become obsolete. The progress of the human mind in useful knowledge appears to know no bounds. Notwithstanding all this, we see that the goal of knowledge is and remains at an infinite distance, and the remarkable saying of the old German professor, Wolft, is more and more verified, which was: "All that we possibly may learn, is only an infinitely small portion of what there is left to be known."

Hippocrates, the father of medicine and founder of the true medical philosophy, commences his glorious and remarkable book with the well-known sentence, "*Ars longa, vita brevis*"—*the art is long, life is short.* But as transitory as individual life is, compared with the existence of the human race, (which it is now proved has existed at least 200,000 years on our planet,) just as transitory is the existence of the human race, compared with the existence of our globe, and again, just as transitory is the existence of our earth, as a globe, compared with the existence of what we call the universe, which itself is but a transitory outgrowth of the eternal forces which animate the eternal matter.

Astronomy, aided with the powerful modern telescopes, reveals us the history of the formation of the starry and planetary systems. Geology, aided with all the light of physics, chemistry and natural history, reveals to us what properly should be called the natural history of our earth. Both agree that the most stupendous changes have gone on, as well in the motion of our globe as in its physical condition; changes which we now commence to see, that never took place by paroxismal action, spasmodically, but slowly, after well-fixed natural laws of continuity, and we must come to the conclusion that, as the different conditions through which our earth passed were transitory, so its present condition is transitory, notwithstanding it may for us short-sighted men appear to be of the most perfect stability.

But the question raised, and which gave some apparent ground to the idea of perfect stability, was this: Were not all these changes preparatory operations necessary to prepare the earth to its present perfect state, which being once reached, the stability was secured and strictly maintained? As far as facts were known about a century ago, this appeared really to be the case; the time

of rotation and revolution of the planets appeared perfectly regular, unchangeable; also their relative mean distances; there appeared to be no resistant medium in the planetary space which possibly could retard their motion; our planetary system appeared a perfect *perpetuüm mobile*, and, indeed, was pointed at as a perfect, frictionless, illustration of such; the time of rotation of the earth appeared not to be changed to any perceptible degree since 2,000 years, the disturbances in the course of the planets found by Newton, and caused by their mutual attractions, was demonstrated by La Grange and Poisson to compensate themselves in a certain long period of time. The temperature of the earth appeared constant—an opinion still erroneously shared by some philosophers of the present day,—and the wearing away of the continents by the action of waters in rivers, etc., appeared compensated by the upheaving power of volcanic action.

But to us, who have the good fortune to live in the latter half of the nineteenth century, new facts have been revealed. I speak here of the good fortune of living now; and indeed when we look back only 200 or 300 years, and even less, and compare the manner of life without the use of steam, electricity, or a thousand other comforts of the present day, we must confess that, with our present experience, the world, at that time, was scarcely worth living in. If the progress in the next century be as great as it was during the last, the vital state of men a hundred years hence will be of a nature of which we cannot possibly conceive the details. If the progress be little, then in future centuries our nineteenth will be pointed at as the great era in which man learned to subject the forces of nature, and made them subservient to his purposes, as the era of the greatest progress the world ever saw; but I am satisfied that the progress in the centuries to come will far outstrip the progress made in former centuries.

The discovery of Römer, in Denmark, almost 200 years ago, that it takes the light eight minutes to reach us from the sun (which corresponds with a velocity of 190,000 miles a second), was a starting point of investigation in a new line, of which we at present see the fruits.

The speaker at this point explained how the planet Jupiter was found. Next he gave an account of Prof. Alexander's fantasy on light and Omnipresence, and after describing Herschel's penetrating telescope, with enlarging objective, he proceeded:

Newton maintained that the light consisted of corpuscles thrown

off by the sun, and all luminous bodies with the above velocity, through the empty planetary space; Huyghens, a Hollander, maintained that it was transmitted like sound, by vibrations in an elastic medium, which fitted the planetary space; and this last opinion was adopted as the most probable by the ablest philosophers, till at last the existence of such a medium was proved in two mutually independent ways.

Arago devised a method to determine if the vibratory theory of Huyghens was correct, and his ideas were executed by Foucault and Fizeau, in France, and it was established beyond a shadow of doubt that light is propagated like sound, by vibrations, and that consequently a medium must exist in the space through which it may propagate these vibrations, as sound is propagated in air as its medium.

The other proof was this: The effect of a medium actually obstructing free motion, was first discovered on a telescopic comet, called after its discoverer the comet of Encke, and has afterward been verified on the comet of Biela, and on most other comets, and is now an established fact. But why are we not able to detect the effect of such a retarding medium on the revolution of the planets? For two reasons: First, that the planets are so much heavier bodies than the comets, which are light above our conception, thousands of times lighter than hydrogen, which is the lightest substance we know, and is 12,000 times lighter than water; heavier bodies with much inertia are not apt to be so easily affected by a light resisting medium than lighter bodies, having little inertia; but the principal reason is, that this resistant medium revolves in one plane, probably in the same direction and with about the same velocity as the planets; as now the comets move in different planes and all possible directions, they must, of course, be affected by the resistant medium.

This is verified by the motions of the moon, which, in its monthly course around the earth, moves one-quarter of the time, just as the earth, and one-quarter of the time slower, another quarter toward the sun, and in another from the sun. The retardation in the moon's motion has long been doubted by astronomers, and traces of such a retardation formed, till finally the English astronomer Adams (the same who also calculated about the existence of the planet Neptune, discovered by Le Verrier), has quite recently not only proved that the moon retards in its motion, but he has even measured the amount of that retardation, of which the necessary

result will be that the moon finally will unite with the earth, that is, fall down ; but before that time another result will be brought about, namely, the attraction of the moon in originating the tide waves in the ocean, which running west, strike against the east coasts of all lands, necessarily cause a retardation in the revolution of the earth around its axis, which obstructed motion of the ocean tide waves is after the law of the conservation of forces, converted into a rise of temperature, which compensates a part of the earth's loss of heat by radiation, and retards the cooling process; however, we live now in a period of the earth's history that this retardation is balanced by the acceleration due to the contraction of the earth by cooling, which is still slowly going on, and explains the rise and descent of certain parts of the continents, which always is taking place, as observations prove. There was a time that the cooling and consequent contractions was much greater than it is now, and during that period the earth's rotary motion was accelerating ; and there will be a time that this cooling and contraction will be less than it is now, and then the tide wave, caused by the moon's attraction, will retard the rotation more and more, the moon coming all the time nearer, its influence will increase and the tide wave run higher, the earth turn slower and slower, till finally it will turn always the same side to the moon, then our night and days will be as long as the time between two full moons. The moon has, perhaps, gone through this very same process by the attraction of the earth, at the time that part of her was still liquid ; she is now entirely solidfied.

Finally, in the course of ages, the moon must unite with the earth, and the earth's solid crust will not only be broken up, by the shock, its centre of gravity shifted, and every thing on its surface utterly destroyed, but by the destruction of the moon's motion an equivalent quantity of heat, several thousand degrees, will be generated, enough not only to melt both, but to convert the whole surface in a fiery ocean ; this molten globe will then go through the same cooling process the earth has passed through, perhaps, more than once ; another crust will be formed, geological deposits will succeed one another, and a new vegetable and animal life will appear, and pass again through the thousands of millions of similar transformations, the relation between which constitute now, the great problem of our age, of the origin and transmutation of species.

Mayer, indeed, thinks that it is highly probable that such pro-

cesses of combination, between different parts of our globe, may have repeatedly happened before the earth attained its present magnitude, and that luxuriant vegetation may, at different periods, have been buried and destroyed under the fiery debris resulting from the conflict of its now component masses. And if so, the idea of the possibility of a shifting of the poles of the earth, suggested by some, is not altogether absurd; however, it must be observed that if this shifting happened by the fall of enormous masses, it was long before our earth had its present surface, and any product of anterior life must, by necessity, have utterly disappeared, and all traces of it destroyed by such a terrible concussion.

We have an illustration in the heavens of a number of very large meteoric masses not yet united to a single planet, namely: in the asteroids, where some 100 bodies move about the orbit, evidently destined for the planet between Mars and Jupiter. The existence of so many planets in this orbit in place of a single one, was at first explained by the hypothesis, that the planet had burst like a bombshell or steamboiler, and the pieces propelled about; others have supposed that it was simply a ring like the one around Saturn, which, by losing its cohesion, broke up in pieces, which, by their centrifugal force, were projected into space; all those ideas are but remnants of the notion that the planetary systems originated by masses projected from centres. I have attempted to show that the planets and sun are formed by meteoric masses falling together from a condensing nebula, and the number of asteroids will, of course, go on diminishing as long as some of them come within the sphere of mutual attraction; before the end of the planetary system they all may be united to one single globe. There is no doubt that Kepler was right in saying that there are more comets and other masses floating about in space than fishes in the ocean, and after the idea of Olbers, the meteorites are almost everywhere moving in all possible planes and directions; those moving in the plane and direction of the planetary system are the least retarded, the others are continually retarded by the resisting medium, which transmits the luminous and caloric waves, and, therefore, they must ultimately fall in the sun. Newton already had the idea that the comets would ultimately fall in the sun and raise its temperature, and Mayer thinks that the fall of meteorites in the sun is continually taking place, forming as it were its natural food, and by the heat developed by the fall, retard its cooling and prolong its manner of existence as a fiery ocean.

One of the latest and boldest explanations of the periodical meteoric showers, is given in the last number of the French Journal *Cosmos*, at the occasion of a report of the session of the French Academy; it is founded on the idea of Olbers, I have referred to, and the author supposes that the earth in the course of ages has hollowed out for itself a kind of empty rut among those flying meteoric masses, attracting all within the reach of its gravitation; but as from time to time by the periodical inequalities in its orbit and the numberless perturbations to which it is subjected, it moves not exactly in the old rut, it will attract other meteoric masses, thus far escaped its attractive power; the moon as it extends its cruise for a circle around the earth more than fifty of the earth's radii, will of course have a large share of the meteors it meets; coming so much further from the mean track of the rut; she also may send in by her attraction some of the meteors she fails to attract to herself.

Such a number of dark masses moving about in space may interrupt a small portion of the light of some stars, and thus explain some of the irregular periodicities observed in their degree of luminosity.

If then by the influence of a resisting medium in space, the planets finally will spirally come nearer to the sun, unite with it, may the sun unite with other suns, with which he is now revolving in space around the common centre in the pleyades, and the whole present arrangement must come to an end; there is one consolation left, namely, that calculations prove that it will take billions of millions of centuries before such a catastrophe will be accomplished; now these numbers are entirely beyond the limits of anything we can distinctly conceive, and are at first sight only fitted to overwhelm and confound all our powers of thought; but we must not forget that our conception is rather suited to the wants of common life, of which it is an outgrowth, than to a survey of the universe. The duration of the present form of the universe may be unmeasurably great in our eyes, though demonstrately finite. Such enormous numbers are continually brought under the notice of every one who investigates nature : the smallness of the microscopic objects, the enormous long duration of the geological periods, all these are expressed by numbers on the same gigantic scale, in comparison with which our space is a point, our time a moment, our millions a handful, and our permanence a quick decay. We are in the habit to contrast the transient fate of

man with the permanance of the forests, the mountains, the ocean, the apparent course of the sun; but this contrast is a delusion, it is only a difference of degree; geology teaches us that forests only lasts for a few thousand years, and then decay or change in coal, that mountains crumble, or subside by convulsions in the earth's crust, that the sea retires, and the ancient shores we find now buried below the mountains resound no more with what we call the everlasting voice of the ocean; now comes astronomy and teaches us that not only the so called everlasting rocks, mountains and ocean, but sun and moon, stars and planets have stamped upon their foreheads the words: *instability*, *transitory condition.* They exist like man, only longer; the ephemeral insect exists a few hours; man a few score of years; an empire, or nation exists a few centuries; a language, a religious opinion, a few thousand of years; a continent, an ocean, has its limited time of existence; and even the very revolutions of the sky, by which we number centuries, will at last have their end, when our earth with all the planets will unite in a common centre and constitute one single globe, which in the course of eternity will unite with other similar globes, and when all the millions of finer stars of our stellar system, commonly called the milky way, have united in one mass, the heat developed may be so great that all will be expanded in a nebula or vapor, extended as far as our stellar system extends now, and then gravitation may reproduce new centres of attraction, and the same history so beautifully taught by Laplace's theory, may be reproduced.

A body of about the size of our sun or of the fixed stars, may be the limit in which matter may remain united to a single globe, but when several millions of such bodies coalesce, the heat may be so great as to overcome gravitation entirely, and to diffuse all as vapor into space, this vapor carrying the heat with it and making it latent, to be set free again by condensation.

I cannot do better than give you, in closing, a translation of a fantasy of the celebrated German orator, Fred. Richter, better known under the *nom de plume* of Jean Paul:

"God called up from dreams a man into the vestibule of heaven, saying, 'Come thou hither and see the glory of My house.' And to the servants that stood around His throne He said, 'Take him and undress him from the robes of flesh, cleanse his vision and put a new breath into his nostrils; only touch not with any change his human heart—the heart that weeps and trembles.' It

was done, and with a mighty angel for his guide, the man stood ready for his infinite voyage; and from the terraces of heaven, without sound or farewell, at once they wheeled away into endless space. Sometimes, with solemn flight of angel wing, they fled through Saharas of darkness, through wildernesses of death that divided the worlds of life; sometimes they swept along frontiers that were quickening under prophetic motion. Then from a distance that is counted only in heaven, light dawned for a time through a sleepy film; by unutterable pace the light swept to *them*, they, by unutterable pace, to the light. In a moment the rushing of planets was upon them; in a moment the blazing of suns was around them.

"Then came eternities of twilight that revealed, but were not revealed. On the right hand and on the left towered mighty constellations, that by self-repetitions and answers from afar; that by counter-positions built up triumphal gates, whose architraves, whose archways—horizontal, upright—rested, rose—at altitude, by spans—that seemed ghostly from infinitude. Without measure were the architraves, past number were the archways, beyond memory the gates. Within were stairs that scaled the eternities below; above was below—below was above, to the man stripped of gravitating body—depth was swallowed up in heighth insurmountable, height was swallowed up in depth unfathomable. Suddenly, as they thus rode from infinite to infinite—suddenly, as they thus tilted over abysmal worlds, a mighty cry arose—that systems more mysterious—that constellations more glorious—that worlds more billowy—other heights and other depths—were coming; were nearing; were at hand!

"Then the man sighed and stopped, shuddered and wept. His overburdened heart uttered itself in tears, and he said, '*Angel, I will go no further. For the spirit of man acheth with this infinity. Insufferable is the glory of the Universe. Let me lie down in the grave and hide myself from the persecution of the Infinite; for end there is none.*' And from all the listening stars that shone around issued a choral voice, '*The man speaks truly;* END *there is none, that even yet we have heard of. End there is none!*' The angel solemnly demanded, '*Is there indeed no end, and is this the sorrow that kills you?*' But no voice answered, that he may answer himself. Then the angel throws up his glorious hands towards the heaven of heavens, saying, '*End there is none, in the Universe of God. Lo! also there was no beginning.*'"

And let me add: No beginning, no end, but eternal transition, one form developing another form, one universe developing another universe, for ever and ever from eternal matter, forever and ever by eternal force, eternal by that Power which governs the motions of constellations and galaxys, and also the emotions of the poor human heart, transitorily imprisoned on the surface of some little planet like ours.

The following paper was read by H. F. Walling, Esq., which completes the discussion commenced by the first paper of Professor Grimes:

The Nebular Theory.

The results of all inquiries into the origin of the earth and other planets and stars must, in the present condition of scientific knowledge be more or less speculative in their character, and, as has been properly remarked during the discussion of this subject, correct theories can only be formed when the observed *facts* are sufficiently numerous to fully establish them. In the meantime, those hypothesis which best explain all the known facts, and which at the same time include the greatest number of them under simple and general laws, are most likely to be finally established and to lead to the discovery of other facts which might otherwise elude our observation.

The Nebular theory of La Place seems to be one of this description, and for that reason has met with very general favor among scientific men. In the paper which was lately read before this association by Mr. Wood, the arguments in opposition to the nebular theory, or more especially to that portion of it which supposes the earth to have been in a state of fluidity and perhaps to still continue so internally, seem to me to be entirely fallacious, I propose briefly to point out its fallacies, without attempting to produce any new arguments in favor of the controverted theory, or of the fluidity of the earth, as this has been rendered unnecessary by the full and able manner in which it has already been explained and advocated.

It is hardly necessary to controvert the first argument of Mr. Wood, that, since force cannot exist independently of matter, no condensation of nebulæ could have taken place, because the consequent radiation of heat into space where there was nothing to receive it would be impossible. This argument would apply with equal weight against the well known facts that the earth and all bodies upon it radiate heat freely into space, as may be made

apparent on any clear night when the clouds do not reflect the heat rays back again to the earth. Are not the sun and fixed stars constantly radiating enormous quantities of heat and light into space? Whether force can exist independently of matter, is a debatable question, but even if it cannot, then we have the *ether*, a material medium, the existence of which is supposed necessary to account for the transmission of forces across otherwise vacant spaces. This supposed ether has the property of receiving heat and other radiations, and of transmitting them indefinitely, or until they are absorbed by some grosser matter.

Whether the substances of which the interior mass of the earth is composed, diminish or increase in density when they undergo solidification, is, I believe, not a matter of certainty; but at any rate the difference in specific gravity would seem to be too slight to counterbalance the immense difference in the rate of cooling between the surface and interior. Convection could not possibly take place with sufficient rapidity to overcome this difference, when the entire mass had, in cooling, approached the solidifying point of temperature, and a crust must be formed as on the surface of lava streams, whose strength need not be very great to sustain itself.

Among the geological evidences which have been supposed to indicate the liquidity of the earth's interior, are included the regularly increasing temperature of the earth downwards, the great number of active and extinct volcanoes, the constant gradual elevation and depression of continents and ocean beds, the connection of volcanic eruptions with earthquakes extending over districts which comprise considerable portions of the earth's surface, the forms and directions of long mountain ranges presenting exactly such an appearance as might be expected in the solid crust of a liquid earth, which by a slight contraction within had made the shell too large, so that by its own weight, upward and lateral pressure would be gradually produced, causing ridges and foldings of the crust, corresponding somewhat in general appearance to the shrivelled skin of a shrunken apple.

Mr. Wood attributes all or nearly all these phenomenas to the mysterious influence of a great unknown central orb, which in some manner analogous to that of the moon in causing tides, and of the sun in modifying ocean currents, produces elevations and depressions in the solid earth, from which, by some means not well explained, the other different results are developed. Now the

tides are known to be purely the effect of the force of gravity, between the sun and moon, and the earth, and the heat of the sun's rays, by changing the specific gravity of the water of the ocean in the different seasons, produces *annual* modifications of the ocean currents, but the force by which a central orb could produce such various and irregular changes as are attributed to it, in the form of a solid globe, without manifesting itself in a corresponding manner upon the liquid ocean, where even the slightest air-currents produce perceptible movements, must be widely different from any force now known to us.

While admitting that the interior heat of the earth increases with the depth, Mr. Wood argues, with some apparent force, that fluidity is not a necessary consequence, because the enormous pressure produced by the weight of the masses above, would cause solidification at very high temperatures. The laws by which solidification would take place under excessive pressure are not, perhaps, well enough understood to enable us to judge of this with certainty, but such experimental knowledge as we possess points in the opposite direction. The ocean always freezes at the surface, and not at the bottom; and Tyndall has shown that ice is converted to water by pressure at a temperature below the freezing point. In other words, pressure lowers instead of raising the temperature of the freezing point. We are sometimes made aware of the enormous force with which this pressure is resisted, when the temperature of water in confined vessels becomes at length so reduced that crystalization or freezing takes place. Vessels of immense strength are burst in this way, rocks are split asunder, &c. I am not aware whether volcanic eruptions and earthquakes have been attributed to this property of expansion in passing from fluidity to solidity, but it seems to me worthy of consideration. The gradual cooling under pressure of a thin layer of liquid next to the outside crust would, at the proper moment, result in an instantaneous outward pressure, and the crust would probably yield at its weakest points. Mountain regions having yielded to the force of lateral pressure would be likely to yield most readily to this action, for it is here that the least resistance is offered to pressure either outward or inward.

But the final and culminating argument of Mr. Woods is that gravity is the cause, not only of the internal heat of the earth, but of the sun's heat. He adduces the observations of navigators, to the effect that the ocean is a few degrees warmer at considera-

ble depths than at the surface, and assuming that while convection is going on, the temperature must be the same at all depths, draws the conclusion that gravity, instead of internal heat, must be the cause of this increase of temperature. It is hardly necessary to remark that uniformity of temperature is the ultimate result, and not the attendant of convection, which cannot take place except when the heat is in excess below, and ceases as soon as uniformity is restored. Some of the ideas in regard to force which were advanced, are remarkable, to say the least, and the conclusion arrived at, that "the true cause why the earth is not drawn into the sun, as well as why two molecules do not touch, is not the centrifugal force, but the force of heat," will, I think, rather surprise those who are familiar with the principles of mechanics.

A transposition in this statement of the cause and effect, would, in my opinion, make it more probably correct. In other words, it is not improbable that heat is simply the momentum or centrifugal force of atoms revolving about each other in orbits. I propose, in a future paper, to suggest a possible way in which this may take place, and to exhibit some models in illustration.

An attempt has been made to reconcile the apparent conflict which exists between the phenomena of gravitation and the law of conservation of force, by supposing force to exist in a latent or "potential" form as well as in an active state, so that in the case of gravity the amount of its force is measured, not by its intensity at any particular point, but by the entire effect, which it is capable of producing. This accounts for the disappearance of the force which takes place only by giving the last force a name, and it appears to me, moreover, to complicate unnecessarily our ideas of the nature of force. The simplest way to define force is to call it "that which, in becoming associated with matter, produces motion or change of motion." In a paper published in *Silliman's Journal* for September, 1865, I have shown that an external and universal force might produce gravitation without undergoing any variation in quantity.

I consider the nebular hypothesis to have undergone mathematical demonstration. It explains a very great number of facts of which no attempt has been made at explanation in any other way, and not one fact is in conflict with it. The apparent variation in some of the outermost planets and their satellites occurs where irregularities would naturally be expected, and are among those exceptions which confirm the rule.

The probabilities are millions to one in its favor. The only other way in which the opponents to the theory explain the facts upon which it is founded, is the same by which in the early days of geological science, timid theologians and others explained the appearances which indicated so strongly that certain geological strata had been found at the bottom of the sea. They said it was just as easy for the Almighty to create these strata, with the enclosed fossils, where and as they were, as at the bottom of the sea. So the sun and planets may have been created where and as they are, but this does not explain why they all rotate and revolve nearly in one plane in one direction, nor why their distances and velocities conform so exactly to the nebular theory of origin. Adjourned.

American Institute Polytechnic Association,
January 24, 1867.

Prof. S. D. Tillman, presiding; T. D. Stetson, Esq., Secretary.

The chairman opened the proceedings with the usual budget on science and art, as follows:

Coast Survey.

The French government have made a survey of the Brazilian coasts, between the La Plata and the Amazon rivers, in which there were taken 178,000 angles and 106,000 soundings.

Plate Glass.

Broadway can no longer boast of the size of its window-panes. One, covering an alcove in the State House at Boston, containing the State battle-flags, measures twelve feet four inches by seven feet seven.

Telegraphic.

A late telegram to California was the President's message, which was published in the San Francisco evening papers the same day it was sent to Congress. The new world still leads the old in telegraphy. America now has 90,000 miles of telegraph lines; Europe 60,000; India 3,000.

Meteor Spectra.

Mr. Alexander Hershel has recently succeeded in obtaining a spectrum of a bright meteor; also the spectra of some of the

trains which meteors leave behind them. A remarkable result of his observations appears to be that the metal sodium, in the state of vapor, is present in the trains of most meteors.

Hot-Water Plant.

The Reese River Reveille states that in the hot water of Hot Creek district is found growing a very delicate vine-like plant, almost as fine as a hair, which holds myriads of tiny leaves nearly imperceptible to the naked eye, and of a bright emerald green. This plant seems to thrive only in water so hot that the hand cannot be held in it.

Pneumatic Express.

From recent experiments conducted by the London pneumatic company, it appears that 128 tons of goods can be sent through eighteen miles of tubes every hour, by means of atmospheric pressure, at a cost of not more than one penny a ton per mile. A part of the economy of this mode of conveyance is due to the fact that the partial vacuum in the tube is produced by means of large stationary steam engines, in which steam is generated most cheaply, and applied with the least waste.

Aerolites.

An iron meteorite, weighing nearly 1,600 pounds, which fell in Mexico, has lately been transported to Paris. There is one in the cabinet of Yale college, brought from Red river, which weighs 1,635 pounds, and contains about 91 per cent of iron, with 9 per cent of nickel. Pallas discovered ore in Siberia of nearly the same weight. The most extraordinary masses have been found in South America. One in Brazil, in size, is equal to 28 cubic feet, and weighs 14,000 pounds; another, discovered in the district of Chaco-Gualamba, is estimated to weigh 30,000 pounds.

Sources of Error in Solar Observations.

Mr. Dauge, of the Academy of Science at Brussels, thinks all the striking phenomena noted by recent observers of the sun may be owing to the refraction of the emergent rays in the atmosphere exterior to the sun's photosphere; and he shows that such refraction may augment the apparent diameter of the sun, and the mean period of its rotation, as well as retard the apparent motion of a spot in proportion as the same recedes from the center of the sun. If these and other phenomena are found, on further experiment,

to be the effect of refraction, astronomers must rectify some results arrived at recently in relation to the sun.

The Locomotion of Fishes.

Mr. Ferdinand Monoyer says: The movement of fishes through the water takes place by the action of the tail, and principally of the caudal fin. When the progression is rapid the other fins play no part in locomotion. When the fish wishes to stop, it does so as an oarsman would, by producing "back-water," which it effects through its pectoral fins. The others may be employed in this latter operation, but their only use is to prevent the fish from turning round on its transverse axis. On the other hand, the observations of Dr. W. Rowell lead him to the conclusion that some species of small fish bend the whole body in propulsion.

The Cattle Plague.

No remedy has yet been discovered for this great scourge. The official report of cases of cattle disease in Holland for several weeks is as follows: Nov. 3, 1866, total for a week, 1,443; Nov. 10, 1,551; Nov. 17, 1,595; Nov. 24, 3,257, and Dec. 1, 7,162. The last number is more than double that recorded in December, 1865. There has been such an alarming increase of cases that certain districts have been entirely isolated. Reports are rife regarding the re-appearance of the disease in one district in Great Britain. Mr. G. Leeman, M. P., stated, at a dinner in connection with a fat stock show at York, that the pecuniary loss of the agricultural community of Great Britain, in consequence of the cattle disease, had been estimated at £3,500,000, and the loss in stock at 5 per cent upon 5,000,000 head of cattle.

The Richness of Milk.

The milk last drawn from the udder of a cow is richest in cream, because partial separation of the cream from the milk takes place in the udder, and the milk which has been deprived of its cream is first drawn. Dr. Anderson found by actual analysis that in one instance the proportion of cream in the last to that in the first cup drawn was as 16 to 1. The quality of milk is impaired if the cow is subjected to too much exercise, because her respiratory organs are then brought into greater play, and the excess of oxygen inspired unites with particles which otherwise would form the butter found in cream. For this reason morning's milk is always richer

than night's milk, and generally stall-fed cows produce milk containing a greater proportion of oily constituents than those allowed to run at large. Dairymen, who understand this subject, do not allow their cows to travel too far to find grass and water, or to be seriously harrassed or annoyed just previous to being milked.

Vacuum Test.

Dr. Lonvel has demonstrated before a commissioner from the French government, a fact before well known, that animal and vegetable substances can be preserved unchanged for any length of time in air-tight vessels from which the air has been exhausted; and further, that these can be in no danger from the ravages of insects. In July, 1864, three sheet-iron cylinders, each fitted with a man-hole at the top, a hopper at the bottom, and an instrument to measure the approach to a vacum within, were filled as follows: The first with fifty hectolitres of wheat and twenty litres of lively weevils; the second with a ton of half-eaten biscuit, swarming with worms and weevils; the third with a ton of the best flour. The air was exhausted in each cylinder, and in this condition they remained until January, 1865, when they were opened. The wheat, biscuit, and flour were found to be in precisely the same condition as when first put into the cylinders; but the worms and weevils were all dead and completely dried up. Two of these cylinders had been kept out of doors, and exposed for six months to all changes of weather. The same process has been adopted for the preservation of the hop, which thus loses neither weight nor its peculiar aroma.

Cells of the Honey Bee.

The plan of architecture always adhered to by bees, the basis of which is the hollow hexagonal prism; has long been a subject of wonder. However, Professor Wyman, after having made numerous careful measurements, avers that the accuracy of the workmanship of the bee has been greatly exaggerated, so much so that whatever the typical form of the cell may be, it is rarely, if ever, realized. Accepting the statement of Professor Wyman, we are still astonished at the systematic mode in which the bee prepares the different kind of cells required for the various sorts of eggs and larvæ. The smallest and most numerous cells are appropriated to the eggs forming working bees, a larger sort to male-eggs, while the eggs which become queen-bees have cells

about one inch long and one-third of an inch wide, with walls about one-eighth of an inch thick. Lastly are constructed magazines of honey and pollen, having their axes inclined to the horizon, the entrances to which are in the highest part, so that the liquid sweets are more secure. Bees sometimes make comb of irregular shape; to prevent this the Swiss use an artificial guide, consisting of a thin plate of wax about two or three inches square, indented all over with hexagonal depressions, which is attached to the inside of the box for storing honey. Experience proves that bees will make more honey when supplied with these cell-commencements than when they are left to take the initiatory steps for the foundation of their wax building.

Cause of the Breaking of Car-Axles.

The Paris *Cosmos*, of December 19, states that Mr. Wedding, a manufacturer of engines in Berlin, has lately attacked the opinion that the rupture of car-axles is due to a crystaline condition obtained by the iron by continuous vibration. His first doubt arose on examining a broken iron beam in his own establishment, which had not been exposed to the least vibration, yet showed a crystaline structure like the broken car-axles. He verified his doubt by experiments, and supported an axle in the center and at one extremity, then suspended at the other extremity a very heavy weight, so that the fibers of the iron in the upper part were expanded, and in the lower part were compressed; afterward the axle was turned, half-way around on its axis, so that the parts first compressed were expanded, and those first expanded were compressed. He again turned the axle half around, and continued this *vice versa* operation until the axle broke, which happened in about four hours. The fractures showed different kinds of molecular structure according to the quality of the iron used. Samples of these fractures were exhibited at a meeting of Prussian technologists, and the opinion was expressed that if iron really underwent such molecular changes, by means of vibration, as had been supposed, its use would be very dangerous for many purposes, and the conclusion arrived at was that if a fracture shows crystaline structure, and want of cohesion, the iron was bad from the beginning.

We must add that the opinion expressed by the principal American iron manufacturers is, that good wrought iron is perfectly reliable, and will never become crystaline or brittle.

Blood Relationship in Marriage.

A memoir with this title, by Dr. Mitchell, is included in a recent publication by the London Antropological Society. The author confined his investigations to Scotland, where his duties as Deputy Commissioner of Lunacy have led him to examine many cases of insanity and defective development, some of which he attributes to the influence of consanguinity. His conclusions are as follows:

I. That consanguinity in parentage tends to injure the offspring. This injury assumes various forms, as diminished viability, feeble constitutions, bodily defects, impairment of the senses, disturbance of the nervous system, and sterility.

II. That the injury may show itself in the grandchildren, so that there may be given to the offspring by the kinship of the parents a *potential defect*, which may become *actual* in the children, and thenceforth, perhaps, appear as an hereditary disease.

III. That idiocy and imbecility are more common than insanity in such cases.

We may add here that the first thorough investigation on this subject was made in the State of Massachusetts, nearly twenty years ago, by commissioners appointed "to inquire into the condition of the idiots of the commonwealth, to ascertain their number, and whether anything can be done in their behalf." Under them 63 towns were examined, and 361 idiots were found. Dr. S. G. Howe, in his able report to the Senate of that State, described many sad cases which were the direct result of misconduct on the part of one or both parents. On the effect of intermarriage of relatives, he said:

"In assigning this as one of the remote causes of idiocy, it is not meant that, even in a majority of cases, the offspring of marriage between cousins, or other near relations, will be idiotic. The cases are very numerous where nothing extraordinary is observable in the immediate offspring of such unions. On the other hand, there are so many cases where blindness, deafness, insanity, idiocy, or some peculiar bodily or mental deficiency, is seen in such offspring, of the first *or second* generation, that one is forced to believe they cannot be fortuitous. Indeed, the inference seems irresistible that such intermarriages are violations of the natural law, though not such flagrant ones as always to be followed by *obvious* and severe punishment.

"Out of 359 cases in which the parentage was ascertained, one-twentieth of the whole were the offspring of the marriage of rela-

tions. Now, as marriages between near relations are by no means in the ratio of one to twenty, nor are even, perhaps, as one to a thousand to the marriages between persons not related, it follows that the proportion of idiotic progeny is vastly greater in the former than in the latter case."

In these instances most of the parents were intemperate or scrofulous; some were both the one and the other. Of course, there were other causes to increase chances of infirm offspring beside that of intermarriage.

"Then it should be considered that idiocy is only *one* form in which nature manifests that she has been offended by such intermarriages. It is believed by some that blindness, deafness, imbecility and other infirmities are more likely to be the lot of the children of parents related by blood than of others. If so, and it seems likely that it is, then the probability of unhealthy or infirm issue from such marriages becomes fearfully great, and the existence of the law against them is made out as clearly as though it were written on tables of stone."

Japanese Alloys.

Raphel Pumpelly, Esq., obtained from the native workers of metals in Japan information relating to the composition of some of the alloys made by them, of which the following is a condensed account:

1. *Shakdo*, an interesting alloy of copper, with from one to ten per cent. of gold. It is used for a great variety of ornaments, as sword guards, pipes, clasps, &c. After being polished, they are boiled in a solution of sulphate of copper, alum and diacetate of copper (verdigris), by which they receive a beautiful bluish-black color. When only one or two per cent. of gold is used, a rich bronze is produced. When pure copper is treated with the above named solution, it presented the appearance of an enameled surface, with a rich reddish tint; and brass thus treated has a similar surface, with a darker shade.

2. *Gin ski bu ichi* ("quarter silver") consists of copper, with from 30 to 50 per cent. of silver, and has a rich gray color.

3. *Makume* consists of several alloys and metals, associated in such a manner as to produce an ornamental effect. Beautiful damask work is made by soldering together, one over the other, 30 or 40 sheets of gold, *shakdo*, silver, rose copper, and "quarter silver;" then cutting holes partly through the whole, after which

the plate is hammered until the holes disappear, and then it is boiled in the above named solution.

4. *Brasses* (*sin chu*).—The first quality consists of 10 parts of copper and five of zinc. A lower quality of 10 parts of copper and 2.7 of zinc.

5. *Kara Kane* (bell metal).—First quality, copper 10 parts, tin four, iron five, zinc 1.5. Second quality, copper 10, tin 2.5, lead 1.33, zinc five. Third quality, copper 10, tin three, lead two, iron five, zinc one. Fourth quality, copper 10, tin two, lead two. In forming bell metals, the copper is first melted, and the other metals are added in the order stated. The best small bells are made of the first quality, and large bells generally of the third.

6. *Solders*.—For bell metal, brass 20, copper 10, tin 15. For brass 10, copper 1.5, zinc six. For silver, silver 10, brass five or three. For "quarter silver," silver 10, brass five, zinc three. For *mokume*, silver 10, brass 1.5. For *shakdo*, fine shakdo three, zinc 10. For tin, lead five, tin 10. The brass used in these solders is of the first quality.

The Japanese articles having a bright red surface, which are sometimes brought to this country, have been supposed to be either a lacquer or an enamel. They are, in fact, made of copper containing red oxide through the entire mass; after receiving a high polish, they are boiled in the solution first mentioned.

Elastic Paper.

The chairman presented a specimen of elastic paper, the invention of Mr. A. T. Dennison, of Mechanic Falls, Maine. The elasticity was given to the paper by passing it through fine fluted rollers, which corrugate it.

Staveless Barrel.

Mr. Mayo's staveless barrel was next exhibited. It was composed of some 15 pieces of veneer wood. These thin sheets of wood were wound spirally, and the grain of each piece made to cross the other at right angles. The machine for sawing these thin boards will cut some 60,000 feet of the rough timber a day. The barrel is made on a form, the inside first, and each piece crosses the other spirally, the next piece being reversed, and so on to any required thickness. Each layer of wood is firmly glued to the other. The glue not being acted on by oil makes the barrel adapted for holding petroleum. No hoops are used on the outside, but on the inside; thus making a radical change in barrel

manufacture. There is a groove turned out at the top of the barrel for the head to rest in. A 40 gallon barrel would cost about two dollars. Petroleum barrels are made of seasoned white oak, and would cost four dollars, while these can be made from the green stock of any kind of wood. A man and two boys can make a complete barrel in one hour and forty-five minutes. The weight of these barrels are about 50 pounds each. A barrel of this kind filled with oil was heated to 120 degrees and then plunged into ice water, and no leakage was perceptible. The wood used is known as scale board, and thirty thicknesses can be cut to the inch.

Dr. L. Feuchtwanger addressed the association on

Gold—Its Sources and Origin.

About the year 1828, after the discoveries of gold and platinum in Siberia, geologists declared that these metals belonged to the older fossiliferous rocks, overlaid by secondary and tertiary deposits. From a consideration of the gold found in the Urals, Murchison supposed that the supply decreases as we descend. This theory was again put forward when our El Dorado produced, in 1849, over thirty millions. It was then maintained, that as soon as the placer diggings should be exhausted, the gold must diminish. We have, nevertheless, since obtained one thousand millions of gold, and in the period immediately preceding the report of 1866, about fifty-five millions, so that the yield is constantly on the increase as we penetrate into the earth. Dr. Feuchtwanger confessed he had been led into the same error on the early Californian discoveries, for he held that all the alluvial gold which came down the Sierra Nevada and filled the rivers Stanislaus and St. Joachim, was brought down when a general terrestrial revulsion took place at a very late period. and when, in eastern Mexico a general tornado submerged several towns, like Palenqua; also, that such revulsion took place in nearly one latitude, or, in a line from San Diego, on the Pacific, in lat. 32° along New Mexico, to the eastern portion of Mexico. In this opinion he was partially confirmed by a report of Lieuts. Emory and Abert, who stated that gold was so plentiful in Santa Fé that the children filled their quills with gold dust taken from the sands. He now coincides with Dr. R. P. Stevens, that gold occurs in veins, or rather, that gold, if found in veins, does not belong to one

series of rocks, but that it shares its formation with the metaphoric, such as the talcose and argillaceous, graywacke, greenstone, mica and gneiss schists, which can be proved by specimens he brought from California. Hitchcock states that gold and platinum always occur in metallic states, and they usually have been explored in drift. They are often associated with other rocks, and in this country especially, a gold deposit has been traced from Canada to the southern part of Georgia, and the metal is embraced in the talcose slate formation, in veins usually of quartz. The same is in California, although eruptive rocks are there more common. Dana says that nine-tenths of all the rocks of the globe have been formed at the close of the Palæozic period (silurian, devonian and carboniferous,) and before the Mesozoic, or Reptiles. During the revolution that followed, these beds, besides undergoing in many regions an extensive crystallization, were also supplied with mineral wealth. Much of the gold of the world comes originally from rocks which were metamorphosed and filled with veins at this time. None of the precious metals are known to occur in the crystalline azoic. The veins of gold quartz which contain the gold were brought forward through fissures of the slate, but were not filled up from below by injection, an idea offered to account for the formation of metalliferous veins, but by long continued heat, accompanied by uplifting and disturbance of the beds.

The geysers and other great volcanic eruptions have probably produced the immense metamorphization of such minerals as are associated with the gold-bearing quartz veins, such as iron pyrites. The continued heat beneath the ocean, must have produced a decomposition of the sulphur and iron from the pyrites, and dissolved either the silica or produced fissures, in which the native gold found a place. When young, Dr. Feuchtwanger supposed that as gold is six times specifically heavier than any crystalline or other metamorphic minerals, and it being only found in its native state with platinum, (which is twenty-one, gold being nineteen, and all other rocks, crystalline and metamorphic, 2·5 specific gravity,) both metals must naturally have been thrown out by central fire from the spheroidal crust along with the igneous rocks in their original fluidity, but which settled down first on account of their great specific gravity. It is generally supposed that the volcanic eruptions have produced metamorphose or transformation, and Leibnitz's theory, promulgated in 1680, that our whole planet was

once in a state of liquefaction by heat, appears to corroborate such ideas. It must not be forgotten that all our observations have been made near the surface, and that we have explored but a small portion of the exterior of our planet, say ten miles; while according to late calculations the crust of the earth is eight hundred miles thick. The crust is occupied by distinct mineral masses or rocks which are divided into four great classes: *Aqueous* or sedimentary, or fossiliferous; *Volcanic*, or unstratified, and in which no fossils are found; *Plutonic*, which form the lofty mountains, and *Metamorphic*, or stratified crystalline rocks, which are the slates or schists, such as gneiss, mica schist, clay slate, chlorite slate, etc., and correspond in form and arrangement to those of sedimentary formation, and which, according to the Huttonian theory, were originally deposited from waters, but were afterwards so altered by subterraneous heat as to assume a new texture.

It was supposed that granite was first formed together with a crystalline or metamorphic strata, and therefore called primitive, and that the Neptunian or volcanic rocks were afterwards superimposed, but that all formations, whether stratified or unstratified, earthy or crystalline, with or without fossils, were alike regarded as of aqueous origin. In the middle of the last century Lehman divided the rocks into three classes: the first and oldest he called primitive, which comprised the plutonic and metamorphic rocks; the next he called secondary, including the aqueous or fossiliferous strata; and the third, alluvial, formed at the deluge. The origin of the first was purely *chemical;* granite and gneiss, with no organic remains, therefore antecedent to the creation of living beings, and coeval with the birth of the world itself. The secondary formations must have been *mechanical* deposits, produced after the planet had become the habitation of plants and animals. This theory was lately improved by Werner adding a *transformation* between the primitive and secondary. The Neptunian theory of Werner became a great favorite; he went so far as to class trappean rocks—the origin of which was fully demonstrated to be igneous—in the aqueous, and as mere subordinate members of the secondary formations. That volcanic action must have been a very powerful agent when in connection with water leaves no doubt, and it must be considered that in a large portion of the earth live volcanoes have existed for ages, and are still in existence. From a consideration of a magnificent eruption of a volcano seen by him

in Guatemala, Dr. Feuchtwanger thinks that a number of such natural phenomena may be able to upset any theory of the formation of the earth, unless based upon the fact that volcanoes form all terrestrial revulsions, and are indisputable evidences of internal heat. We know volcanoes, both extinct and active, bordering the Pacific from Fuega to the Arctic, through the Aleutian Archipelago to Asia, down the Asiatic coast through Kamschatka, Japan and the Phillipines, to New Guinea, New Hebrides and New Zealand. In Hawaii the volcanoes are nearly fourteen thousand feet high.

The fact that the precious metals have been discovered in volcanic regions, such as Mexico, California, and in all the South American States, and that in California we may travel for many miles over volcanic lavas, obsidian, which is sometimes called volcanic glass, the direct offspring from volcanoes, must bring to mind the relationship of gold. It was believed that marine shells and fossils were the effects and proofs of a general deluge, and must therefore have been deposited under water. By a fossil is meant any body, or the traces of one, whether animal or vegetable, which has been buried in the earth by natural causes. The remains of animals, particularly those of aquatic origin, are found almost everywhere imbedded in stratified rocks, and sometimes, as in limestone; they form the entire mass of deposits, like the encrinitic rocks of Medina limestone, N. Y. State, and the deposits of tripoli, and fossil shells, of forms which now abound in the sea, are met with far inland, both near the surface, and also at a great depth below and at all heights above the level of the ocean, at an elevation of nine thousand feet in the Alps, at thirteen thousand feet in the Andes, and above sixteen thousand feet in the Himalayas; and, according to Dr. Stevens, fossil shells have been found in North Carolina filled with pure gold. All this proves that the earth has undergone many great revolutions, and that both the volcanic and Neptunian actions have produced jointly the results which daily come under our observation, and other powerful agents, such as earthquakes, glacier currents, and other dynamical powers, have brought about the present state. The earthquakes, which are mostly the forerunners of great volcanic eruptions, and which often extend over vast areas of land, have been proved to be connected with the heat from the interior of the earth, and Sir William Herschel imagined that the elementary matter of the earth must have been in a gaseous state,

resembling the great phenomenon of nebula in the heavens, so fast that if concentrated they would form solid spheres. The glaciers, or ice streams, which are accumulations of ice descending by gravity along valleys from high elevations, may have also been active in revulsions of the earth, and upset whole countries by their force, as Agassiz recently stated in his lectures on the Amazon, that the flat topped hills which are found many hundred miles from the sea coast, are remarkable for the evidences of the glacial action which they display. From the gigantic terrestrial or land agencies, we must turn to the ocean forces, the currents which exercise a powerful influence in the formation and existence of the globe. They are chiefly produced by winds, and extend over several thousand miles in length, and nearly half as much in breadth, and are of great velocity and of great depth. With the ocean currents are also connected the tidal waves and currents, the wind waves, as also the earthquakes. The force of waves is so great that on the Scotch beach a block of gneiss, weighing forty-two tons, was moved five feet from its place at one time. We are also at a loss to determine when the most important periods or eras have taken place. If we judge from the period in which the Niagara falls have receded six miles from their original bed, and if we suppose that they receded at the rate of one inch annually, it would have required three hundred and eighty thousand years to perform it.

The discussion of the selected subject was then taken up.

Beet Sugar.

The chairman said Margraff, a Prussian chemist, first discovered, in the year 1747, that the beet contained sugar. Achard, another Prussian chemist, as early as 1773 made various attempts to manufacture sugar from the beet, under the patronage of Frederick the Great. The death of his patron compelled him to relinquish the investigation, but he resumed his experiments some years later, and in 1799 presented specimens of loaf sugar from the beet to the King. His report on the subject was republished in France and attracted the attention of the Institute, but a committee from this body having stated, as the results of their experiments, that only one per cent of sugar could be extracted from the beet, no attempt was made in France to manufacture this variety of sugar until the time of Napoleon, who, finding the supply of sugar from the cane was nearly cut off, ordered new experiments to be made

with the beet. Imperial factories were established, and 100,000 acres of land were devoted to the cultivation of beets. In 1812 the sum of $200,000 was appropriated to encourage the production of this root; but soon a political revolution put an end to these schemes, and in 1814 every manufacturer of beet sugar failed except one, Crespel Delisse, who continued the business. However, in December 1814, the impost on sugar was fixed at about three and one-third cents per pound, and the duty on foreign sugar was established at fifty per cent advance or about five cents per pound. Under this regulation the home trade revived, and various improvements were made in the manufacture; still the amount of beet sugar produced per annum was comparatively small, being in 1828 only 4,665 tons. In 1833, when the duties were fixed at from five to eight cents per pound, the amount was 12,000 tons. In 1837 the amount was 49,000 tons. In 1840 the duties were lowered, and the production for that year was only 22,000 tons, but ten years later the annual amount had risen to 64,000 tons. In 1857 the product was 80,874 tons, but, for reasons not known to us, the product of the succeeding year was nearly doubled, being 150,444 tons. In 1862 the yield was 173,675 tons, yet the succeeding year furnished only 108,495 tons. The total for 1864 was 145,745 tons, and for 1865 the astonishing amount of 270,000 tons. In the same year, in the Zollverein, were produced 180,000 tons; in Austria 80,000; in Russia 50,000; in Belgium 30,000; in Poland 14,000; in Holland 5,000; in Sweden 1,000, making a total of 630,000 tons. The whole number of factories devoted to this manufacture was 1,426. In Russia 438 factories produced less than one-fifth the amount made in 420 French factories. The average annual product of a factory in those countries where the manufacture is most successful is 600 tons.

In France, under the protection of a tariff, the price of sugar has gradually decreased. At Paris the average price of raw sugar, exclusive of duties, in 1816, was 12½ cents; in 1826, 10.3 cents; in 1857, 7.6 cents; in 1860, 6.1; in 1864, 5.2 cents; in 1865, 5 cents, and in April 1866, only 4¾ cents per pound. Thus it will be seen that while the prices of sugar, exclusive of duties, has decreased since 1816, in France, nearly two-thirds, the production has increased to more than forty fold. Mr. E. B. Grant estimates the total production of sugar throughout the world at 2,800,000 tons; the proportion from the four principal sources is as follows:

Sugar from the cane, 71.42 per cent or 2,000,000.

Sugar from the beet, 22.50 per cent or 630,000.

Sugar from the palm, 5.00 per cent or 140,000.

Sugar from the maple, 1.08 per cent or 30,000.

It will be seen by the figures presented that, although the amount of beet sugar is now less than one-third of that of cane sugar, the rate of increase is greatly in favor of that from the beet, which is now produced in France without any protection and against the competition of the world. This result has been effected by improved machinery and chemical processes, the practice of fattening cattle on the beet waste, and the cheap price of labor. The problem to be solved in America is whether on cheap lands and with the use of improved machinery we can compete at the north with the owners of the productive cane lands in Louisiana in the manufacture of sugar. The few attempts already made in this country have not been successful. This was to be expected. Such has been the early history of the beet sugar manufactories in every country—we are yet to learn that we have failed to do in this country what has been done in any other similar climate when we have seriously undertaken the business.

The evening was so far advanced that it was resolved to take up the subject of beet sugar at the next meeting. Adjourned.

American Institute Polytechnic Association,
January 31, 1866.

Prof. S. D. Tillman in the Chair; T. D. Stetson, Esq., Secretary.

The chairman opened the proceedings by presenting the following summary of scientific news:

French Semaphores.

These signals on the coast of France are now connected with the whole telegraphic system of the empire, so that captains of ships may send and receive orders without the necessity of entering ports, or even quitting their course.

The Cohoes Mastodon.

The remains of a mammoth found a few months ago near the Mohawk river, at Cohoes, N. Y., have been presented by Mr. Alfred Wild to the State Cabinet, and are deposited in the Geological Museum at Albany. After being treated with oil, the fossils will be placed on exhibition.

Novel Fire Annihilator.

Mr. David F. Masnata, a resident of the island of Cuba, has seriously proposed to use soda water in the extinguishment of fires. We hope Mr. Masnata will invent some very cheap mode of generating carbonic acid gas, so as to lessen the price of our favorite beverage.

Starch in Potatoes.

Dr. Nessler, of the Duchy of Baden, has shown by analysis that the nutritive value of potatoes varies with their size, and in favor of increased bulk. Potatoes about two inches in diameter contain 17.2 per cent. of starch, and those about the size of walnuts 14.6 per cent. We infer that full growth is necessary to full development of starch.

Fine Collection of Maize.

Mr. William S. Carpenter, Esq., of the American Institute, has transmitted to the Paris Exposition, by the ship Mercury, 115 varieties of Indian corn, each of which has a name. The most remarkable ear in this collection contains 1,290 grains, arranged in twenty rows. The name of this variety is the Western Gourd Seed. It is probable this collection is the best ever made.

Tuning Forks.

These forks are raised in pitch by filing off a portion of the end of each branch, and lowered or flattened by filing off a portion of the side of each branch. Dr. W. Rowell has ascertained, by a series of experiments, that the pitch of a given steel fork is not changed in the slightest degree by being hardened and then softened, or *vice versa*. Admitting the correctness of the assumption that steel is slightly expanded by the hardening process, the question arises, is not the increase of elasticity just sufficient to compensate the flattening effect of elongation?

Albumen.

At the last meeting of the American Photographical Society, Prof. Tillman remarked that albumen plays so important a part in the animal economy, and has of late become so useful in the arts, especially in certain photographic processes, increasing interest is excited regarding its composition. It forms about seven per cent. of the blood and ten per cent. of the white of egg, and in both exists as an alkaline albuminate. Its atomic formula, as deduced by Leiberkuhn, is, according to the new notation, $C_{72}\ H_{112}\ N_{18}$

O_{22} S. The replacement of one atom of hydrogen by one atom of sodium forms albuminate of soda, found in white of egg. Gerhardt coincides in this view, and the latest investigations of Lehmann seem to confirm it, although he prefers to describe albumen only by its percentage analysis. We are at first struck with the fact that the atoms which form this compound atom or atomoid are expressed by very high numbers. It is ranked among the most complicated of chemical structures. No definite opinion can be formed as to its actual constitution, however the speaker had found this singular numerical relation of its several elements. The number of atoms of hydrogen in the compound is equal to the sum of the number of atoms of carbon, nitrogen and oxygen; and further, that the atomic ratio of carbon and nitrogen is as four to one. A knowledge of these relations has no practical value at present, unless it be in chemical classification, based on multiples of hydrogen; yet it may be the clue by which we shall finally arrive at the cause of the stability of albumen as a chemical structure.

Preservation of Flowers.

At several fairs of the American Institute dried flowers, in their natural colors and shape have been exhibited. Flowers thus perfectly preserved are now for sale in London shops. The process of preservation is this: A metallic vessel is provided with a movable top and bottom. The top cover is removed, and a wire gauze of moderate fineness is fitted into the top of the vessel, when the cover is replaced. Sufficient sand to fill the vessel is first sifted, and then placed in an iron pot with a small quantity of stearin—about half a pound to 100 pounds of sand. The mixture is heated, and carefully stirred, so as to equally diffuse the stearin. The first vessel is then turned upside down, the bottom cover removed, and the flowers to be operated on are placed in the wire gauze, after which the prepared sand is gently poured in so as to cover the flowers entirely, the leaves being thus prevented from touching each other. This vessel is then put in a hot place—such, for instance, as the top of a baker's oven—and left for forty-eight hours. The vessel is then taken out, and, while still bottom upward, the lower cover is removed, and the sand runs out through the gauze, leaving the flowers uninjured and dry, yet still retaining their natural colors.

A New Actinic Light.

In England artificial light is often used for producing photographic pictures. Mr. Sayres has invented a new compound having high actinic power. It consists of twenty-four grammes of nitrate of potash, well powdered and dried; seven grammes of flour of sulphur, seven grammes of red sulphuret of arsenic. These ingredients are thoroughly ground together. Four hundred grammes in burning will make a light lasting one minute at a cost of about three cents; while light from the combustion of magnesium wire, for the same length of time, costs about twenty-five cents.

The Tallow Tree.

This tree, indigenous to China, has recently been introduced into India, and there are now tens of thousands of trees on the Government plantations. The tree fruits abundantly both in the Dhoons and on the plains, and grows with great rapidity. Many trees raised from seeds planted eight years ago are now at least two feet in diameter. Dr. Jameson prepared from the seeds of the fruit one hundred pounds of tallow, half of which has been given to the Punjab railway, in order to to have its qualities as a lubricant of axles tested. This tallow burns with a clear, inodorous flame, and without smoke. The leaves of the tree are valuable as a dye, and the timber, being white and close-grained, is well fitted for printing blocks.

Color of Deposited Silver.

M. Carey Lea, of Philadelphia, noticed a curious fact in the course of a photographic experiment. A plate was covered with a considerable thickness of ammonia-nitrate solution, to which was added a dilute solution of Rochelle salt. The plate was then placed in the sunlight and left for some time. Reduction took place, and the evaporation, which went on simultaneously, had exhausted over about one-half of the plate, when it was removed from the sunlight and carefully washed. All that part of the metallic silver on which the solution had been suffered to dry in the sun was pure steel gray, while that which was removed, still wet, had a strong reddish bloom. The contrast between the two was remarkable. It was, moreover, quite permanent, and evidently depended upon some difference of *molecular* arrangement.

Egyptian Brick.

Prof. Unger, in a paper read before the Academy of Vienna, gave the results of his examination of brick from the pyramid of

Dashour, which dates back from 3,400 to 3,300 B. C. He found many natural and artificial objects of interest perfectly preserved. Besides two sorts of grains—wheat and barley—he met with field-pea and common flax; the latter having in all probability been cultivated as an article of food, as well as for spinning. Of the class of common weeds, he discovered wild radish, corn, chrysanthemum, wart-worth, nettle-leaved goosefoot, bearded hare's ear, and the common vetch. The presence of twine and sheep's wool is significant of the advance of civilization at that early period. Chopped straw was found mixed with the burnt clay, which confirms the account of brick-making during the sojourn of the Israelites in Egypt given in Exodus, as well as the description found in Herodotus. Prof. Unger proposes to continue his investigations in this direction.

The November Meteors of 1866.

Dr. Phipson, of London, says: "Though many thousand persons have been fortunate enough to witness the magnificent display, a still greater number were fast asleep in their beds, and, believing that such a sight can only be seen every thirty-three years, regret what they have lost. The latter will be glad to learn that from the observations already collected respecting the late star-shower, it appears more and more probable that, although so fine, it was not the great display so anxiously awaited, and that we may confidently expect another, perhaps more magnificent still, from the 11th to the 14th of November, 1867." On the other hand, Prof. Newton, of Yale College, says: "The brilliant exhibition of the November meteors witnessed in Europe on the 14th of that month, is a confirmation (if such confirmation was needed), of the astronomical character of these bodies, and of the thirty-three year cycle," from which we infer a greater display than the last is not to be expected next November."

The Burning Star.

The star first discovered by Mr. Birmingham, of Tuam, on the 12th of May last, in the constellation Corona, which rapidly increased in brilliancy for some days, and then as rapidly declined in brightness, has been examined with the spectroscope by W. Huggins, F. R. S., and Prof. Miller. They report that its spectrum is unlike that of any other Celestial body. The light is compound, and has emanated from two different sources. The principal spectrum is like that of the sun, and the second spectrum,

consisting of a few bright lines, indicates that the light by which it is formed was emitted by matter in the state of luminous gas; further, the position of two of these bright lines intimate that this gas may consist of hydrogen. The whole phenomena suggested to them the rather bold speculation that, in consequence of some vast convulsions taking place in this object, large quantities of gas have been evolved from it; that the hydrogen present is burning by combination with some other element, and furnishes the light represented by the bright lines; also, that the flaming gas has heated to vivid incandescence the solid matter of the photosphere. As the hydrogen becomes exhausted all the phenomena diminish in intensity and the star rapidly wanes.

Animal Chemistry.

The North British Review for December, contains an able exposition of the recent investigations in relation to the conversion of food into force, from which we extract a single paragraph:

"Leibig and his supporters contend that albuminious bodies form the natural fuel for the muscular machine, which they consider is alternately wasted and repaired, as a consequence of its work; the contraction of the muscle being due to oxidation, the relaxation to repair of its wasted parts. To this Frankland and his supporters bring in opposition the fact observed by E. Smith and Voit, that suddenly increased muscular effort is not attended by augmented muscular waste. This is an important fact undoubtedly, but it is equally incomprehensible on Frankland's views as on those of Leibig. If the urea be the mere representation of the waste of the animal machine due to friction, why, when that friction is increased does not the urea increase in proportion? What we do know is this: that the force manifested by the muscles must be the result of transformation of a motion of molecules into a motion of mass. But we are entirely ignorant of any arrangements in the body by which heat can be transformed into mechanical work; nor does our acquaintance with the mode of working common machines give us the smallest clue to the unwinding of this problem. The only fact upon which Fick, Wislicenus, and Frankland repose their system is, at least, as inexplicable upon it as it is upon that of Leibig. A theory is certainly defective when it fails to explain an important phenomenon; but it is not science to substitute it by a second theory which also entirely fails to

include the very same phenomenon that for the present stands excluded from the first."

Some discussion followed, as usual, the reading of these items.

In connection with the item on "tuning forks" on hardened steel, Mr. James Harrison said he had experimented with steel and found that on hardening it diminished in size. A piece eight inches long on being hardened shortened one-sixteenth of an inch.

With regard to the "Albumen" item, Mr. Joseph Hirsh stated that large quantities of albumen are now made in Chicago from blood of swine slaughtered there. His father uses up all the blood to be had there for that purpose. This albumen is bought by calico printers. Albumen used to be worth seventy and eighty cents a pound; but now it is sold at about fifty cents. In Germany eggs are sold at two cents a dozen, while here they are now worth sixty cents.

Mr. S. H. Maynard said the albumen of eggs is used in making photographic paper, that from fish is entirely discarded.

Mr. J. W. Chambers presented samples of Peabody's Sea Island cotton, and read a letter in relation to it.

The regular subject was taken up, and the following paper read:

Manufacture of Beet Sugar, by Joseph Hirsh, ph. dr.

The production of sugar from beets, and the establishment of a branch of industry which has now attained huge proportions, is not, cannot be, traced to a mere accidental discovery, but is the legitimate result of careful and long-continued observation, study and diligence, ever combined by a cold northerly climate. A detailed account of the advance in the manufacture would show progress made step by step against the greatest prejudices, while ridiculed and pronounced hopeless even by such men of science as Liebig. Yet, in spite of almost insurmountable difficulties, the world did move; and while France in 1829, produced 80,000 pounds of beet sugar, the supply in 1858, was increased to 98,452,182 pounds, or 492,260 tons, made in 600 manufactories.

Only so late as 1747, the German chemist, Markgraf, published the results of his experiments with different roots, especially the beet and sugar beet, in which he proved the presence of crystallizable sugar, unknown or doubted until then. His discovery remained a scientific curiosity merely, without bearing any practical results; and it is to his talented disciple, Francis C. Achard, that the credit belongs of examining anew all the plants which, in the

cold northerly zone of Europe, could be raised with profit for the production of sugar, and of being the pioneer in the art, by erecting in the year 1796 the first large establishment for the production of beet sugar, situated in the county of Cuneva, in Silesia. In 1799 and 1812, he published his first complete treatise on beet sugar, which was so precise, distinct and plain, and moreover was treated in such a thorough practical manner, that it aroused the attention of the English sugar merchants, and caused them to make him the generous offer of 50,000 Prussian thalers, on condition that he would discontinue his experiments with beet sugar, and so kill this industry at its birth. Nobly refusing this offer, the sum was subsequently quadrupled, in the hopes of inducing him to publish another work setting forth that his enthusiasm for the beet sugar manufacture had carried him too far, and that experiments on a large scale had not realized his expectations. This offer was also declined. The English merchants had now become thoroughly alarmed at the progress the new manufacture was making on the continent, and made one last effort to crush it, by engaging Sir Humphrey Davy to write a work in which he sought to prove that beet sugar was bitter. But even this very learned treatise was of no avail, for all over Europe beet sugar was consumed, and its bitterness was pronounced to exist only in England. Napoleon's continental blockade, at the beginning of the present century, stimulated the new industry; and though the enterprise was encouraged by all the crowned heads of Europe, yet the main practical and successful aid was given by Napoleon I., to whom belongs the honor of being the second founder of the beet sugar industry.

The discussion of the beet sugar manufacture should be preceded by that of the beet itself, and its cultivation. The sugar beet cultivated in Europe, is known under several varieties, the favorite one being the Silesian. A cross section of this beet exhibits a white dense structure, in a few of its varieties, having concentric rose-colored rings about three eighths of an inch wide. Its juice has a concentration of 8° to 9° B, and contains but a small proportion of impurities. A second variety of beet is the Burgundy, which grows out of the ground, has a loose porous texture, a great deal of highly diluted juice, and on this account is undesirable for the production of sugar. The properties of a good beet are the following: uniform shape, and if possible without branchings or forks, as these are likely to retain impurities

from the field, impart them to the juice, and impede the production of crystallizable sugar. The beets should not weigh less than one pound, nor more than five, smaller ones being washed and ground only with difficulty, while those larger generally have a too diluted juice. The beet should further have a firm, uniform texture, should make a loud cracking noise on breaking, and should sink in water. Those that break readily are easily ground to pulp, a necessary property, while half dried old beets are somewhat elastic, and therefore difficult to be reduced. It is also desirable that the beet should be white, although this is not necessary. The juice should be sweet, concentrated, and contain few impurities, its concentration varying from 4° to 12° B. The beet should not grow above the ground, as that portion has a loose texture, a thick skin, a watery juice, is rich in salt and poor in sugar, and freezes easily during cold winter nights. To obtain these results the ground should be well ploughed, manured a year before planting (the best previous crop being wheat, although beets may be grown scccessively for a number of years without exhausting the ground.) Nitrogenous manure is to be avoided, as it increases the nitrogenous protein substances of the beet, consuming its entire vital power while its proportion of sugar remains small. The best time for sowing is between the latter part of March and the first of May. The sowing is made diagonally through the fields, as this uses space more economically than the square way of planting. The seed should not be over one year old, and is to be put in the ground abundantly to insure a full harvest. Rainy seasons are dreaded, as too much moisture produces large beets containing a watery juice, many salts, and but little sugar, while dry seasons commonly produce good beets. The time of harvest lasts from September to October, the latest crop being always the sweetest. When pulled, the loose dirt is shaken off, the leaves and side branches are cut off, and remain to act as manure for a future crop. The yield per acre varies from 12,000 to 18,000 pounds, the average being perhaps 15,000, which is equal to about 1,200 pounds of raw sugar.

The thorough cultivation of the beet is the first condition of success, as a poor beet opposes too many difficulties to its economical employment. The best ground for beets is black mold, humus or sandy or limy loose ground; clayey soil, as it retains too much moisture, is less desirable. The beets after harvesting, must be

preserved from frost, by storing in ditches three feet deep and three feet wide, in which the ground is pounded firmly, covered with straw or boards about four inches, then with a layer of earth about six inches high. At distances of six feet, bunches of straw are placed in the ditches, to act as escape tubes for the vapors arising from the beets. These ditches are generally made 60 to 120 feet long, the piles of beets reaching three feet above ground. Occasionally these piles are made entirely above ground, and covered with a layer of earth ten to twelve inches high. Thus preserved the beets will keep until March. In Russia, occasionally, wooden sheds are used, under which, upon strips of wood or in baskets, the beets are piled four to six feet high; this mode of keeping is cheapest in the end, although the first cost is considerable.

The production of juice in a pure state necessitates the thorough washing of the beet, for which purpose a drum is employed, made of wooden strips, about ten feet long, and four feet in diameter. The drum lies somewhat inclined to one side, in a tank filled with water, into which it reaches to the depth of a foot. The beets fall from a large hopper into the drum at one end, passing out at the other upon an inclined plane, whence they are conveyed by a large archimedean screw, traveling in an upward direction against a continuous current of fresh water, until the cleaning is completed.

After washing, the decayed portions, beet tops and rootlets, parts containing juice poor in sugar and rich in salts, are removed by revolving knives, and what remains is thence conveyed to the crusher or rasping cylinder, revolving six hundred times per minute, and is rapidly reduced by it to pulp, and in this condition is removed to the presses. The rapidity with which this operation is completed, corresponds to the acuteness of the angle between the direction of pressure of the beet and the tangent of the cylinder at that point; for if that angle is a blunt one, the saws will simply scratch and not cut the beet, hence the pressure must always be directed against the side of the cylinder. During the operation of crushing, a continuous current of water cleanses the cylinder, dilutes the juice, and facilitates its removal from the pulp. The latter contains now forty per cent. in volume, or about one per cent. of its weight of air. The cylinder and pulp box are cleaned every six hours to prevent oxidation of the juice.

The pulp, as fast as made, is spread on cloths made of raw silk, the whole being supported by perforated plates of sheet iron.

These charges, to the number of thirty or more, are placed under a hydraulic press, and a pressure is applied at first from fifteen to twenty atmospheres to the square inch, gradually increasing to one hundred and twenty to two hundred atmospheres.

The pressing surface is generally twenty-four inches, and each press cloth is charged with sixteen pounds of pulp. The pressure is regularly increased for from eight to fifteen minutes, remains thus for some five minutes, and is then released : the juice expressed during this operation ranges from eighty to eighty-four per cent. of the weight of the beets.

Beside silk, wool, horsehair and hemp are used for press cloths. Frequent washing of these is necessary, ammonia commonly being added to the water to neutralize acidity and dissolve slime ; soda and lime were formerly used for this purpose, but it was found that these soon weakened the fibre of the cloth. The pressed cakes are used as cattle-feed.

Another method of separating the saccharine juice from the pulp, first introduced by Schöttler, is by placing it in a metallic cylinder finely perforated, and caused to revolve at the rate of one thousand revolutions per minute. The centrifugal force causes the juice to be expressed, but a great amount of fine pulp is driven out with it through the meshes, causing trouble in the subsequent operation of defecation. By this method, also, an immense amount of froth is produced, which has to be run separately into a vat, and condensed with steam. A charge for a centrifuge is two hundred pounds, and this is exhausted in fifteen minutes, or thirty charges can be made easily in a day. Among other methods which have been used may be mentioned ordinary rollers, pressure with compressed air or gases; these have been tried, though, with but little success. The method of maceration lately came into use, recommends itself for its completeness and simplicity ; also in that it does away with expensive pumps and presses. In the cells of beet pulp, in contact with water for some time, an endosmotic process is carried on, the water entering the cells and giving out the saccharine juice, until the liquid within and without possesses an equal density. If, then, one hundred pounds of beets, reduced to pulp containing ninety-six pounds of juice, are mixed with an equal weight of water, endosmosis will produce a juice of half the original strength, but double the quantity. If this be withdrawn, and the same proportion of fresh water be again added, the juice contained in the cell of half the original

strength is again reduced, possessing then one-quarter of the original strength. If a juice contains eighteen per cent. of sugar, which is a fair average sample, the progress of this reducing process, for six consecutive times, leaves a juice in the pulp of but one-quarter per cent. of sugar, or one almost free of saccharine matter. The juice obtained by all these dilutions is too watery for economical evaporation, and must be concentrated by the same process by which it was diluted.

The juice obtained from the first dilution of the original juice of sixteen per cent., contained eight per cent. of sugar. If this now be brought in contact with its weight of fresh juice of sixteen per cent., a mixture will be the result containing twelve per cent. Continuing this process six times as before, the final resulting liquid will contain 15.875 per cent. of sugar, or almost its original concentration. These results, however, are not always to be obtained completely in practice.

The process of maceration, now chiefly employed on a large scale, is that introduced by Schuetzenback, and consists in placing the beet pulp in vats provided with an agitator, to keep it constantly in motion. The vats have a false perforated bottom for the complete removal of the liquid, and a corresponding perforated top, the holes of which serve as distributors of the exhausting medium. Twelve tubs form a battery, and the transmission of exhausting liquor between the different exhausters is effected by means of a rotary pump. The motion of the agitator should be about twenty-two turns a minute, neither fast enough to make much froth, nor so slow that the pulp will float. This process furnishes eighty-nine per cent. of beet juice, or five per cent. more than presses, having simplicity and cheapness of apparatus in its favor, the juice being also cleaner, not coming in contact with cloths, &c., which induce decomposition.

The amount of water requisite for this process is four times that of the weight of beets. The exhausted pulp is generally pressed, to be preserved as cattle feed. Other methods of maceration were tried with partial success. Among them may be mentioned the maceration of beet slices, suggested by Markarat and carried out by Dombasle, in 1821. The points of contact between the beet and exhausting medium being diminished, the maceration is less complete than is that of pulp. It required at least six hours, which affords the juice time to ferment.

In 1837, Pelletan introduced an *exhauster*, consisting of an Arch-

imedian screw, which carried the pulp upward through boxes, while water was carried downward to exhaust the pulp. This screw was afterwards used vertically by Hallette and Boucherie. Elevators were tried in tubes, carrying beets upward, while water ran in an opposite direction. The maceration with hot water in closed vessels is carried on successfully in Seelovitz, Moravia, by Mr. Robert. Schuetzenbach proposed the maceration of dried beet slices, which, upon exhaustion, give a more concentrated liquor (18° B'é.) and enable the manufacturer to work and use his machinery during the summer months. The disadvantages of this process are the expense for drying and the consequent destruction of some crystallizable sugar.

The beet juice, no matter in which way produced, contains, beside sugar, foreign substances which during the subsequent operations destroy the sugar partly, or prevent its crystallization. The removal of these substances is therefore of vital importance. This is effected first by defecation. The juice, by whatever manner obtained, runs at once into the "defecating pans," made of copper with an outer iron shell. Between the latter and the bottom of the pan steam is introduced, as soon as the bottom is covered with juice, until the juice in the pan has a temperature of 175° to 190°, F. The steam-gauge is then closed almost entirely and milk of lime added, which is slowly heated to the boiling point. At the first boiling up, the steam is completely shut off, the lime being most effectual at this temperature. The addition of lime produces flakes in the juice which rise to the top, forming a scum. If the proper amount of lime is added, this scum will begin to move at 189°, F.; if too much lime has been added at a higher temperature, and at a lower one if too little lime has been used. At this first wave-like motion the scum also grows denser and darker. The juice below is clear, and may be withdrawn after a few (15) minutes. The scum sinks to the bottom, whence, with the sediment, amounting to 18-30 per cent. of the juice, it is run off into a bag filter. Here the juice slowly is separated, while the thick scum is afterwards pressed in the bags, and so deprived of its juice. The bags have to be washed as quick as emptied, frequently, in diluted muriatic acid, to remove the lime. This defecation changes the black color of the juice into yellow and removes its turbidity. The lime unites with the organic acids as well as the phosphoric and sulphuric present in the juice, removing them thus, while it decomposes albumen, legumine, extractive

matter, proved by the evolution of ammonia, while the heat also coagulates the albumen, rendering it insoluble. Too much lime produces an undue quantity of sediment. As it generally contains alkali, it is repeatedly washed before used. Its amount employed is ½ of 1 per cent of the weight of the beets. Too little of it produces a greenish, turbid liquor instead of a yellow clear one. After addition of the lime a small quantity of the liquoris lft to settle, after which it is breathed upon, when a slight scum or cover will show that enough of it has been used. Toward the end of the season the amount of lime has to be increased, as also the organic acid increases. The juice dissolves about ¼ per cent. of lime, the other one, or ¾ per cent., being precipitated. The entire pan process of defecation of one batch consumed about an hour. The defecating pans are small (200 gll.) and numerous, so as to use up small quantities of juice as fast as made. In some places lime is added to the fresh juice before its introduction into the defecating pans, to prevent its decomposition.

Some of the lime dissolved by the juice unites with the sugar to saccharate of lime; this sugar would be lost to the manufacturer unless the lime is removed. This is done with carbonic acid, which removes about 60 per cent. of the lime, and afterwards by filtration, which again removes 50 per cent. of the lime left after the first treatment.

The carbonic acid is produced from chalk with muriatic acid, or cheaper, by the combustion of coke or charcoal. For this purpase a kiln similar to a lime-kiln is used, where a constant supply of coal or coke is furnished. The products of combustion pass through a large heap of lime, thence through two water tanks to be cooled and washed, thence into a large cooler filled partly with diluted soda lye. From the top of this vessel a pump withdraws the gas, its suction producing the draft in front to keep up combustion, and forces it into the beet juice. Six pr. ct. carbon give with 16 pr. ct. oxygen 22 pr. ct. carbonic acid. Coke and charcoal contain about 80 per cent. of carbon.

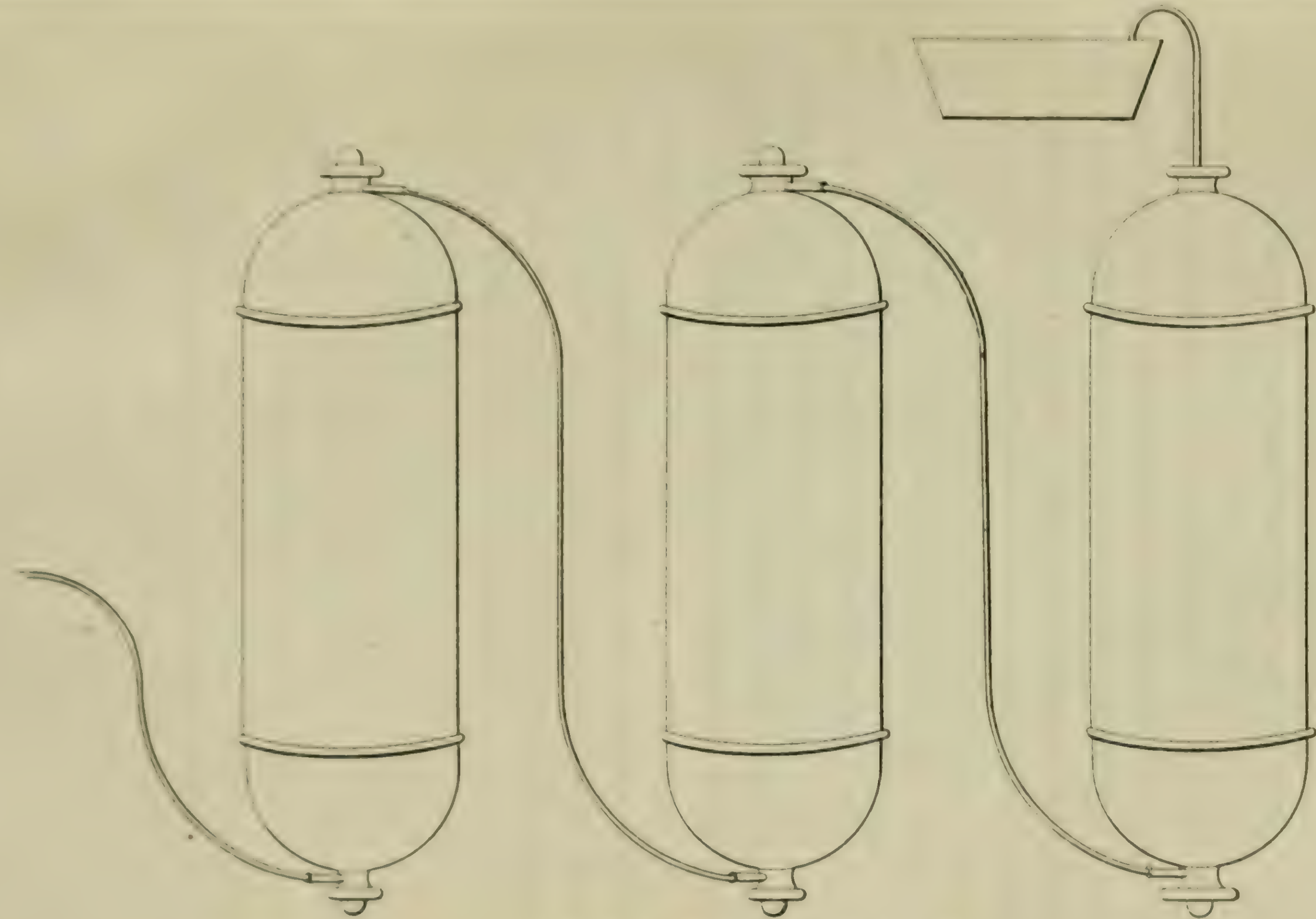
Another source of carbonic acid is lime, which loses about 44 per ct. of carbonic acid gas by burning. This is done in continuously acting kilns, a fuel free from sulphur being employed upon a furnace, surrounding the kiln, which the gases enters through four flues. They pass through the kiln upward, thence through a pipe into a washing tank, having three partitions, filled with water, and

are withdrawn from there by a pump, which also forces them into the juice. In some places pretty pure carbonic acid is produced by the decomposition of chalk in retorts, by means of superheated steam. This process furnishes the same true pure lime for defecation. The heat must never go above red heat; to prevent the production of hydrogen. The retorts used are generally seven feet long and fifteen inches in diameter. Sometimes, though seldom, the carbonic acid of distilleries is collected and employed for the removal of the lime. Also chimney gases are sometimes washed with alkalies and used, but always darken the color of the juice and prevent crystallization to a hard grain. These products of combustion contain 10 to 18 per ct. of pure carbonic gas. For its application the gas is forced into a closed box or pan filled with juice. At one end this box increased to double its heighth, to give the juice rising space, a sieve being interposed between the pan and this addition, from which a tube carries off the waste gases. On admission of the gas the liquor froths a great deal, and has to be kept down by fat, butter or stirring; it rises into the additional space. With the decomposition of the saccharate of lime the liquor becomes less coherent, sticky, and ceases to froth. By this sign the conclusion of the process is judged, as also by the quick precipitation of large flakes in a small sample, taken from the pan. As soon as this takes place the access of the gas is shut off, and the liquor heated to the boiling point by means of a steamcoil or jacket. This causes the sediment of carbonate of lime to be less voluminous. It is then withdrawn to settling vats or settled in the saturators, after which the clear liquor is withdrawn into the forefilters, to be entirely purified before admission upon the last filters. This forefilter consists of a small iron tank, in which a sieve is suspended, filled with boneblack, in the midst of which is a narrow vessel for the collection of the juice, which thence is withdrawn by a syphon. The carbonate of lime, remaining at the bottom of the forefilter, is placed into bags, the juice expressed, and the lime used as manure. The liquor is then lifted into the filter reservoirs by means of montejus, in which every atmosphere of steam pressure lifts the juice twenty-nine feet, consequent upon the density of the juice. In these filter reservoirs the liquor is heated, as in this state it keeps better and permeates the boneblack better, which is used as a filtering medium by being thinner. Boneblack was first suggested for that purpose by Figeur, in 1811, and tried first by Charles Derosne, in 1812. At first only its decolorizing power

was noticed and valued, but later the main service, rendered by the black, was found to be the absorbtion of alkalies, salts and other substances, impeding the crystallization of sugar. In this respect filtration is only a second defecation. The boneblack was first used in the powdered state, being boiled with the sugar-juice. It then could be used but once. In 1828 Dumont introduced the use of coarsely grained boneblack, which he used in small filters. The action of a filter is increased with its heighth in proportion to its diameter, for then every particle of liquor passes through a greater amount of black, exhausting it more thoroughly than when the diameter is greater in proportion to the height; hence the rule that filters should be at least ten times as high as wide.

The height of filters for the economical use of bone-black, in quantities proportionate to the present scale of manufacture, would render the use of filters necessary higher than sugar refineries generally are. For this reason filter batteries are employed, i. e., a series of filters communicating with each other. They are generally arranged in the following way: The empty space between the grains of bone-black is sufficient to hold fifty-five to sixty per ct. of its weight. The amount of bone-black used is twenty per cent of the weight of beets, or twenty-two per cent of the weight of the juice. The filters are closed at the top to prevent absorbtion of air, which might otherwise cause fermentation, and of ammonia, which is always present in beet sugar refineries, being produced by the action of lime on the protein substances at the boiling point. Where water is plentifully supplied, it might advantageously be used to cool the filter, to preserve the liquor at a low degree of heat.

Besides the shape of the filter, the quality of the bone-black is of importance. It should always be of a dull black, velvety appearance, should adhere to the tongue, when brought in contact with it, both of which are signs of great porosity. When the filter is exhausted, the access of juice is shut off, and steam introduced at the top, which condenses in the pores of the black, and washes out whatever saccharine juice may remain in it. This same process is also gone through with a few times before the filter is used, whereby are removed all the salts from the black; it then has an increased absorbtive power for the salts of the liquor. On the whole, filtration is carried on in the same way as in our American refineries for the manufacture of cane-sugar.



COMBINED FILTERS.

See Page 760.

The filtered beet juice is next evaporated in vacuum pans, as is the case in our refineries, with but this difference, that, while here, after a single filtration, the liquor is at once boiled down to the crystalizing point, beet juice, which contains more impurities, is boiled down only one-half, or to 25° B., and afterwards filtered the second time over bone-black. The filters, before described, are used, thick juice passing first through fresh bone-black, until exhausted, then thin liquor is passed through the same black, which still extracts impurities from this watery liquid. After the exhaustion of the black, by this thin liquor, it is steamed and removed for purification. The vacuum pan, one of the neatest pieces of machinery employed in manufacture, is used in Europe with a view to more economy than in this country. Here single pans are used, the vapors of which are condensed by water. In Europe the heat of these vapors is used to evaporate juice in one or two adjoining pans, where liquor is boiled under a still more reduced pressure. The steam, after heating the second pan of syrup, has lost a great deal of its heat, and requires two-thirds less water for condensation, than that coming from a simple apparatus. The difference in temperature, between the two or three pans, during boiling, is about 30° F., the first being at 165° F., the second at 146° F., the third at 100° F., or even below that.

In order to preserve these boiling points, in accordance with the density of the liquids, the pans communicate, so that into the third pan fresh liquor is flowing, which, after some concentration, rises into the second, and thence, again, after a lapse of time, into the first pan, where it acquires the density of 25° B. In this state it passes through a montejus upon the black filters, whence it comes, or should come, pure enough for final evaporation to the crystallizing point. This, as well as the after treatment of the sugar, is the same as that employed in our refineries, with but this difference, that the yellow sugar or dark-colored syrup, gained in claying of the sugar forms, is not brought into market in this inferior state, but is worked over again, at the end of the beet season, into white loaf-sugar or, though seldom, added as it is produced, to fresh beet juice in the defecating pans. Where these after-products are worked separately they again yield more impure molasses, which is again worked over. In this manner six different products are gained. The sugar, crystallizing at first from such an after-product, is usually of an inferior quality,

and is generally refined over, the following year, with fresh juice, in which it is dissolved. The molasses, remaining behind at the last operation, contains 35 to 40 per cent of salts, chiefly potash; it tastes bitter and acid, and is unfit for sweetening purposes. It is mostly used by distillers, who again sell their exhausted mash for the manufacture of potash. In some places it is used as manure for beet fields with excellent success. The molasses is kept in holes, on those fields, over the summer, but towards fall these holes become covered sometimes by a deposit of brown sugar, which is collected and worked over, while any liquid portion is mixed with the soil, returning the substances taken away with the previous harvest.

These after-products, when boiled down to sugar, are boiled to a less concentration than fresh juice, in order to facilitate the separation of the impure molasses in claying. The latter is chiefly done in centrifuges for these inferior qualities of sugar, while ordinary good sugars are clayed in forms, generally in a vacuum.

The manufacture of beet sugar is not by any means perfect yet. When Achard obtained two per cent of sugar from the beet, he considered himself doing well. Now, with improved machinery and better cultivated beets, from six to nine per cent is produced, which still leaves three to four per cent to be gained by improved methods of working.

Adjourned.

American Institute Polytechnic Association,
February 14*th*, 1867.

Prof. S. D. Tillman, Chairman; T. D. Stetson, Esq., Secretary.

The following scientific items were read by the chairman:

Substitute for Lint.

It is stated that the surgeons of Vienna have used with success, soft, white, unsized paper in dressing wounds. It is a non-conductor of heat, and, owing to its absorbent nature, wounds are kept comparatively dry, and in a favorable state for healing.

Deep Artesian Wells.

The artesian wells of Grenelle and Passy now emit volumes of vapor. The temperature of the waters, rising from a depth of 2,300 feet, is 80 degrees Fah., while that of the atmosphere at night is only 35 or 36 degrees.

A New Hydrocaraon.

Messrs. Friedel and Ladenburg have succeeded in preparing a new hydrocarbon, isomeric with the hydride of œnanthyl, (*eechel*) which they represent by the formula expressing a combination of one atom of carbon with two atomoids of methyl and two atomoids of ethyl.

Cow-Pox.

Mr. A. Cheuveau has shown that what is called *spontaneous* cow or horse-pox can be produced at will by simply introducing virus into the lymphatics, instead of into the blood-vessels. Eight horses were experimented upon by him, confirming this view, and he therefore concludes the power of the vaccine scab is suspended in the air, from whence it is introduced into the lungs of cattle.

Improvement in Promoting Fermentation.

Sulphuric acid has been extensively used by distillers of molasses for converting the mash much quicker into vinous fermentation; this process has been improved by the addition of phosphoric acid, according to the suggestion first made by the French chemist Pasteur, who, regarding yeast as a plant containing phosphorus, believed the process of fermentation might be stimulated by that element. Practical results have proved the correctness of this theory, and many distillers now use the phosphate of soda.

Borax.

The discovery of immense beds of borax in the Cascade mountains has become of more importance from the fact that this compound, which is a borate of soda, is now extensively used in Holland and Belgium by washerwomen, instead of soda. By using a large handful of powdered borax to every ten gallons of water a saving of about fifty per cent of soap is effected. Borax being a neutral salt, does not injure the texture of fabrics, Borax has long been used for cleansing the hair, also as a dentifrice. As good tea cannot be made from hard water *The Medical and Surgical Journal* recommends the use of a teaspoonful of borax to an ordinary sized kettle of such water in which it should boil. The saving in the quantity of tea used will be at least one-fifth. Pure borax is the biborate of soda with ten atoms of water.

Coal-tar Products.

M. Bobœuf, a French chemist, has treated coal-tar with soda, at the ordinary temperature, and obtained benzol, the material which is the starting point in the manufacture of aniline dyes. The soda is said to combine with the heavy constituents of coal-tar; the benzol which floats on the surface of the solution is easily separated by decantation, and is found to be contaminated only with products lighter than itself, which are carried off by a single distillation. The soda compound is chiefly the carbolate of soda (phenate of soda), which possesses all the valuable disinfecting properties of phenic acid.

A New Battery.

M. Rouillion has described, before the French Academy, a new arrangement for generating an electric current by the action of aqua regia. A mixture consisting of two-thirds hydrochloric acid, one-third nitric acid, or three-fifths hydrochloric and two-fifths nitric, will easily dissolve gold and platinum, but will only superficially attack pure unalloyed silver; a superficial chloride being formed which protects the rest of the silver like an impermeable varnish, however long it may remain in the aqua regia. If copper be present the metal is attacked. Rouillion has utilized this fact by making a battery in which pure silver in aqua regia replaces carbon of the Bunsen cell, or platinum of the Grove, in nitric acid. After using the battery for several months he found no diminution in the quantity of silver and no chloride of silver was formed in the porous cell. The inventor states that his battery is more constant than Bunsen's. It further tests confirm this statement the new battery will soon be brought into practical use.

Caoutchouc Septa.

Mr. Thomas Graham, the distinguished chemist, in a remarkable memorial to the Royal Society, "On the Absorption and Dialytic Separation of Gases by Colloid Septa," states that a thin film of India-rubber is impervious to gases, but that the gases may become liquified by contact with such septa, and then transmitted through it by the agency of liquid, and not gaseous diffusion. M. Payen, of France, has taken exception to this statement. He declares that India-rubber abounds with pores through which a gas could pass while in the gaseous condition; under the microscope they are visible when the rubber is dry, but are greatly enlarged, and

so rendered more visible, by the contact of rubber with water, alcohol, or fused sulphur. They are most readily seen in a film produced by the evaporation from a solution of rubber and bisulphide of carbon. It is these pores which give rise to fibers when the rubber is forcibly stretched. Payen contends that water and other liquids are carried into these pores by capillary attraction, and are not diffused through the whole substance as is the case when gelatine or other true colloids absorb liquids. He concludes, therefore, that gases pass through rubber septa, just as they do through septa of graphite, or of unglazed earthenware.

Petrifaction.

True petrifaction is a process of fossilization in which the original mold or cast of an organic fossil is filled up with a kind of matter differing from the original body. Deposits on the surface of objects are sometimes met with which are commonly called petrifactions. A sample of this is the petrified moss at some of the mineral springs in western New York. The carbonate of lime forms an incrustation around the plant. Another variety is silicious deposits on moss, ferns, and other objects found near the hot springs of Iceland. Partial fossilization sometimes occurs, as in the case of the common clam, for instance, which is often found filled with mineral matter while the shell remains intact. A true petrifaction is where the inorganic structure of the whole animal or plant is replaced by mineral matter. Examples of this are petrified palm-trees which are entirely changed in their composition, and yet retain all the fibers and cells in their original form and minuteness, so that, when viewed by the microscope, the species of the tree can be determined. Another common case in point is the echinus, in chalk formations; its shell has been changed to calcspar, while its interior has been filled with flint. The testaceous animal has the power of changing the crystals of carbonate of lime in the construction of its shell, but when life has departed the laws of crystalization resume their sway and the carbonate assumes its original rhomboidal form.

In the beautiful little shell, shaped like a ram's horn, called the ammonite, iron pyrites is sometimes found. It is supposed the sulphur in the animal has united with iron, and although the natural form of the bisulphide of iron is cubical, in this substitution process it is forced to take the rhomboidal shape. In fossilization or petrifaction the organic matter may be replaced by various

minerals, such as gypsum, oxide of iron, phosphate of iron, sulphate of baryta, sulphate of strontia, silicate of copper, carbonate of copper, carbonate of lead, and fluor spar.

The Atlantic Cable.

The time required for the transmission of a signal by the Atlantic cable, has been found to be thirty-one hundredths of a second, which is probably not in error by one hundredth of a second. At this rate the electric current or force would move under the ocean 6,020 miles per second, while on land lines it is estimated to move 16,000 miles in the same time. The perfect insulation of the wires of the two Atlantic cables was lately demonstrated by Mr. Latimer Clark, who telegraphed from Ireland to America and back again with a battery formed in a lady's thimble. Mr. Collett has since transmitted messages with a battery composed of a gun-cap with a strip of zinc attached by a drop of water, the simple bulk of a lady's tear.

The cable has lately been brought into important service in determining the difference of longitude between points in Europe and America. The telegraphic method of determining longitude originated with S. C. Walker, of the United States Coast Survey. Within the last twenty years the longitude differences of a series of points on the United States coast have been determined with an accuracy far surpassing any work of a similar kind done in Europe. The longitudinal relations of places on opposite sides of the Atlantic have until lately rested on the chronometric calculations made by the United States Coast Survey more than ten years ago. Fifty chronometers were transported between Liverpool, England, and Cambridge, Mass., three times in each direction. The difference in the longitude of these places was determined with a probable error of nineteen hundredths of a second, which, although sufficiently precise for commercial purposes, is not so for astronomical purposes. Under the direction of Dr. B. A. Gould, of the Coast Survey, certain points have been determined by means of the Atlantic telegraph, with a probable error of only four hundredths of a second. This will be more clearly understood by stating that 1,900 miles have been measured, and the probable variance from the true distance does not exceed forty feet. It is gratifying to know that American savans were the first to make these important determinations.

Liebig's Extract of Meat.

The Pharmaceutical Journal for November, 1866, contains a communication from Baron Liebig, in which he states that the extract of meat prepared according to his process, at Fray Bentos, and Munich, does not contain any gelatine, or anything that could be considered as such. Gelatine does not belong to the composition of the extract of meat, and must, therefore, be excluded as much as possible; it gives more consistency to the extract, and allows, to the detriment of buyers, of a large percentage of water, and makes it liable to turn mouldy. But the action of tannic acid, as a re-agent, might lead to erroneous conclusions, against which it is necessary to guard. He had stated in his work on "The Chemistry of Food," that the portion of the juice of the flesh which is soluble is cold water but not in alcohol, is precipitated in tannic acid; the precipitate softens like plaster in hot water, and cannot be distinguished from the tannate of gelatine, but it differs from gelatine by that characteristic property of both, that it does gelatinize when concentrated. Extract of meat, then may and does precipitate with tannic acid even when entirely free from gelatine.

By the exclusion of gelatine the yield in extract is naturally diminished. According to a recent communication from Mr. Seekamp, one of the former assistants, thirty-four pounds of fresh lean meat only yield one pound of extract as manufactured at Fray Bentos (corresponding with forty-five to forty-eight pounds of butcher's meat, inclusive of fat and bones). It has been observed that color and taste of the Fray Bentos extract vary; this is owing to the difference of sex and age of the animals. The meat of oxen always yields an extract of darker color and stronger flavor, reminding somewhat of the flavor of fresh venison, pleasant when diluted; the extract of cow's meat is of lighter color and a mild flavor, and is preferred by many persons. The meat of animals under four years cannot be used for the manufacture of extract; it yields a pulpy extract of weak taste, like veal, and without flavor. According to the predominance of ox or cow's meat, the color and taste of the extract varies, which is by no means a fault of the manufacturing process, and is fully explained by the preceding remarks.

The extract of ox meat is richer in creatine and sarkin than the cow's meat extract. He had examined an extract sample manufactured at Darmstadt, containing nine per cent of common salt

beside twenty per cent of water more than the Fray Bentos extract. It is sold in jars with labels stating that the extract is prepared "according to Liebig's process." It is extremely difficult, as regards the extract of meat, the genuineness and purity of which are not discoverable by the eye, to protect the public against frauds; all manufacturers prepare their extract according to what they call "Liebig's process," but since he had given only general, and not special directions for the manufacturer, it so happens that every one fills in the details after his own fashion, and the consequence is that not one of these extracts is, in its composition, like another.

After some discussion on several of the items, Mr. McGuiness submitted a diagram of his boiler, patented some time since, but which has not yet been put into practical operation.

Voiceless Duck.

Dr. W. Rowell exhibited the bronchial tubes of a duck which, when alive, made no sound. He thought this inability to produce sound was the result of disease. It was interesting as illustrating a theory that in the larynx there are organs of speech, which like those of hearing, once destroyed cannot be restored.

Mr. Joseph A. Miller presented the following paper on

Steam Boilers.

The discussion before this association, on the cause of steam boiler explosions, last winter, was not without beneficial results. The foggy notions of theorists, attributing these explosions to electricity suddenly generated, and explosive gases produced by decomposition, have been dispelled, and I hope also the bugbear of low water, and the sudden formation of large quantities of steam from small quantities of heated metal, certainly not sufficient to raise the water ten degrees in temperature. It is now a well proven fact that intelligence, vigilance and honesty are the preventives, as ignorance, carelessness and cupidity are the real causes of boiler explosions. This is true not only of the men in charge of the boilers, but of those who design them and furnish the material, those who construct them, and more often than all, those who use them.

This question of steam boiler explosion is of such importance to all men that I hope it will for more than one evening during this winter occupy the attention and prominence it deserves. One

hundred years ago last November, the first practically perfect low pressure steam engine was completed, and although we may fairly assert that for the first fifty years after its introduction it was scarcely more than an experiment, and that all the wondrous revolutions due to it must be credited to the last fifty years; for when fifty years ago Napoleon laid plans for the use of steam as a propelling power to ships, the most learned men of Paris considered its use an impracticable idea. Yet in this short time, steam has so changed all things, and has withal become so important that if, by some sudden force, men should be entirely deprived of its use, the greater portion of this globe would be plunged back into darkness, want and misery. So silent and steady have been the changes it has wrought that we in our daily walks scarcely perceive its importance; yet, compare the Hindoo blacksmith, crouched on his haunches beating his iron with a stone hammer, with the ponderous steam hammer which forged the propeller shaft of the Great Eastern! Steam is not only the most obedient but the most powerful slave of man.

"The pen is mightier than the sword," said Bulwer, and he was right in the sense he used it, but certainly not in the sense every scribbler is using it to-day. To literary men we are indebted for much, aye, very much; yet if it were not for the advancement in the mechanic arts, their efforts would be futile; not that I would deprive them of the respect, gratitude and veneration which they so loudly demand and so bountifully receive, nor would I do without this hand-maiden of applied science, but demand equal rank and equal consideration. When we cast our mind's eye back over the history of the ancients, we are not surprised at the results which followed the ignoring of the useful arts.

The human race has passed through various epochs; but the last is the most important. Let us call it the practical era. Men will yet look to the steam engine with its iron sinews, and by its aid accomplish such feats as we, even, who have watched its gigantic strides, did not anticipate. That, in all this progress, the boiler must play an important part, is evident; and that it will and must be perfected, and, above all, made safe, is certain. That it can be made as safe as a water-power or wind-mill, can only be doubted by those that have never studied nature's forces and admired the perfection and harmony of her laws. That the boiler

is not safe, alas! is known too well! Yet, can we wonder? It is made without regard to the complex operations carried on within; left to the narrow notions which daily routine too frequently engenders. Mechanically constructed by a boiler-maker it is considered safe, perfect, and will pass inspection if it is only tight, and able to stand a certain pressure.

Incrustation, that greatest source of boiler destruction, is not for one moment considered. Little is done, in most boilers, to insure circulation of the water, so as to carry the steam, as soon as made, into the steam room. Priming is scarcely considered, nor how to protect the boiler against violent and sudden strains. No! it is simply made tight. As to the rest, it is left to chance or good luck, and yet, if the boiler explodes, and kills and maims, the result is laid on some mysterious cause, beyond the control of its engineer or its owner.

When, in a boiler, we find some attention paid to the means of conveying the heat into the water, we will be sure to find the question of evaporation completely set aside. When a boiler foams, or makes wet steam, a steam drum is placed around the chimney or the heat is carried over the top of the boiler, or a super-heater is used; it is true, these have been found useful and beneficial; yet they are at best but remedies and afterthoughts. When not wrong in themselves they show conclusively that there is something seriously wrong in the boiler.

The plainest evidence that steam boilers are built with little true knowledge of the nature and production of steam, lies in the fact that more than four hundred and twenty different forms of boilers are made, each claiming some superiority over the others, and, strange to say, with some show of reason.

Another evidence, and one fully as lamentable, is that one of the latest boilers, and one that has some very valuable features in its favor, claims to be so strong that it cannot—note this—*cannot burst* under any practical steam pressure! Now, what would we think of the intelligence of an individual who, having lost a keg of gunpowder by explosion, would, to prevent the recurrence of such a calamity, have his powder kegs bound with strong iron hoops. Is it probable that the Pacific Mail Steamship Company would carry nitro-glycerine, if put up in spheres, tested to stand 600 pounds pressure? In both cases, the cause, it must be evident, still remains the same, and the effect, we know, would be worse.

If we would prevent disasters we must carefully study cause and effect—the rest to a practical mind is simple.

A steam boiler, intended to work with a pressure of eighty pounds to the square inch, is worse than a powder mill, if, under any circumstances, that pressure can be increased one pound. Some will say the safety-valve is a sufficient remedy, whilst others contend that the same has been found wanting in many cases; both parties are right. A steam generator, in the true sense of the word, one that will make dry steam without super-heating in any manner, one that will simply change the cohesive force of the water into the repellant force of the steam, and leave the water a dense mass, free from steam, wants only a simple and reliable safety-valve. But a regular steam boiler—we had better call it by its true name—a water boiler, wants more, or rather to make it perfectly safe under all circumstances—well, it wants to be kept cool.

I have for years made heat and steam a speciality. I have experimented during that time on a large and small scale, and have carefully examined more than fifty exploded boilers, and conversed with practical engineers and others, both in this and the old country, on this subject, and I must own that the more I search and the more I can see into the laws that lie at the root of the production of steam, the more I marvel—not that steam boilers explode—but that they do not explode more often. On a steamer I hold my life worth but little, when I think that there is more dangerous power stored in the boilers, than there could be in a hundred barrels of power, and, further, that this power is in the hands of men knowing but little as to its nature. If an engineer is asked how he is protecting human life he will point to the glass guage, if such a thing is used at all, considering that all is done that can be done when the water is at a sufficient height. And yet there are many cases on record where it is shown, beyond doubt, that, at the time of explosion, the water-level was at its proper height. There are also many boilers, and particularly of that class known as fire-box or locomotive boilers, in which it is not an unknown occurrence to have water in the upper and steam in the lower gauge. Are such boilers safe? Are they constructed with any defined object, except to boil water?

All things in nature or art to be perfect must have faultless proportions. The strongest column men can fashion is the most

graceful. The strongest beam we can cut from a tree, will show a form most agreeable to the eye. A steam engine that works silently, you may be sure works well. The same is true of gearing railroad rolling stock, and all things that move. It is a fundamental law, that perfection and harmonious action go hand in hand. Most mechanics and engineers hold that steam cannot be raised until the water boils; yet steam is simply vapor, and it is well known, that vaporization or evaporation takes place at all temperatures above the freezing point. Boiling is simply a violent action produced by force, and the boiling point is just that point where the fluid to be evaporated is completely charged with as much heat as it can hold. When water is heated to 212° it boils, that is, the additional heat imparted to it, not being able to diffuse itself through the whole mass, is forced out from the surface by a rapid succession of violent explosions, sending out puffs of steam mixed with water. This is saturated steam, and will scald the hand in contact with it. Dry steam will not do this, for the moment it escapes it performs work of expansion. That perfectly dry steam can be made in contact with water I prove daily, on a practical and large scale, also that a pressure of steam—I mean a working pressure of from forty to sixty pounds can be raised and maintained, with water in the main boiler not exceeding 200° in temperature. This I am ready to prove at any time, on a large and practical scale. And why should it not be so? Are not ponds and lakes dried by evaporation? and is not this whole globe one vast workshop run by steam? Yes, and low pressure steam at that, with condensers, hot wells, and all. Sufficient water is raised to run the mighty Mississippi and a thousand other rivers, and yet all is done without boiling, without violence, without danger, without explosion. Let us look further and how simple is this work performed. The heat is applied at the surface of the water, and behold the vapor rises into a kindred element without violence. Ocean currents spread their heated waters over large surfaces and assist vaporization, while they produce perfect circulation. But what is the action in the best of our boilers? The fire being below the water, the vapor must force its way through this dense medium, but not before the whole water is charged with as much steam as it can hold, which, by the way, is precisely as much as though the water was not there, and in its place were a vacuum. Nor is this all. To positively prevent the steam from leaving the water, we fill up nearly the whole space

with tubes! As to complete circulation of the water, like the ocean currents, it is seldom effected. Most of our boilers can be much improved by simply increasing the circulation of the water, for the more rapidly steam made at the heated boiler plate, can be mechanically carried to the surface, the more power we get from a pound of coal, and so much less danger is there from explosion. Premising that explosion is a violent action by which the boiler is torn asunder, and all the steam and generally all the water forced out, and not a simple rupture of the weakest part of a boiler, letting out sufficient steam to reduce the pressure, I say no boiler can explode that contains only steam and compact water, if a proper safety valve is used. Here a word about the safety valve; it is too frequently the case, that a number of boilers are connected by one steam pipe, and that, for convenience, the safety valve is placed in a position where it can, under no circumstances, be more than a pressure gauge. It is a well known fact, that an ordinary fifty horse-power steam boiler, with ample grate surface and good draft, cannot make steam fast enough to maintain any working pressure with a hole of 2 5-8 inches diameter in the shell or other part of the boiler. Yet if this hole leads into pipe twelve feet in length, having four elbows placed horizontally, the same boiler will make steam enough to maintain forty pounds pressure, while the steam is "blowing off" continually. It must therefore be evident, that *directly* on the boiler and on *each* boiler, is the proper place for the safety valve.

It is laid down in every book on engineering, that a certain number of square feet of heating surface of a boiler, with certain proportion of grate surface, gives one nominal horse power, or at least is equivalent to a certain amount of power. Such is not the fact, and although the amount differs with each statement in such books, yet not one of them is correct, even in respect to the same kind of boiler. After the most careful experiments no such statement can be verified, for surface has no relation to the steam capacity of a boiler, at least not as now understood.

In the well known "Hecker Brothers' flour mills" in this city, where boilers, engines and attachments are of superior construction, and where no expense has been spared to produce the best possible results, I placed within the boilers simple tubes like those I exhibited here some evenings since, and reduced the consumption of coal fully 30 per cent. Also, in a small boiler in this city, by simply improving the circulation of the water, I have

reduced the fuel used from 2,100 pounds per day to 700 pounds, thus enabling me to do three times the work with the same fuel.

In concluding, let me lay down a simple theory concerning the cause of steam boiler explosions, which I do not claim as mine. It is partly the theory of Dr. Ure, Zerah Colburn, Charles Wye Williams, and several other prominent and eminently practical men. In order to be rightly understood, I will commence at the foundation. Neither water nor any other liquid, not confined so as to prevent all expansion, can be raised in temperature by the addition of heat without vaporization, that is, vapor is formed in all liquids as soon as heat is added; and this formation of vapor continues in the liquid until the boiling point is reached, when the liquid, being saturated with such vapor, which it is unable to retain by a succession of explosions, relieves itself of this additional vapor formed. It is for this reason that the boiling point differs with the amount of pressure under which evaporation takes place; and also the reason why the temperature of all liquids suddenly falls when they are stirred. The vapor is mechanically set free, therefore it is evident that the pressure of vapor in the liquid is the cause of the raising of temperature. When we stir the contents of a boiling pot of milk or syrup, the boiling instantly ceases, and the only change is a copious discharge of steam. If the milk itself had been raised to the boiling point, no such effect could be produced, as we do nothing to evolve it.

Steam is an elastic vapor, and its pressure is due to the bulk or number of atoms contained in a certain space. When a boiler works under a pressure of forty-five pounds, the temperature of the steam in the water is 290°. Now water, under atmospheric pressure, cannot be raised to a temperature of more than 212°, excepting when, by some means, it is kept perfectly quiet. In such cases it has been raised to 216°, but instantly falls to 212° as soon as ebolution commenced. It must be evident that the water, being 815 times denser than steam, has the capacity of retaining steam under, at least, the same pressure as that in the steam space; and that the steam contained in the same cannot be released until either the pressure is relieved or its power to expand is increased by heat. That this immense power stored in the water is the cause not only of the rupture of the boiler, but of all the disastrous effects produced, is now an admitted fact. The remedy, and one that, under all circumstances, is a sure one, I claim to have discovered. We all move here under an atmospheric pressure of

fifteen pounds; and yet we are not encumbered, because the pressure is equal on all parts. As a bird, on overcoming gravitation, soars on high, so will atoms of steam. When separated from the water, it will easily rise into its own element in the steam space, no matter what the pressure. If an atom of steam, under only ten pounds pressure, is carried into the steam room where the pressure is 100 pounds, that atom is simply compressed into a smaller bulk; but being surrounded on all sides by the same pressure, it will certainly retain its place, and by this very act of compression its temperature is increased. That such is really the case is shown by the fact that temperature and pressure, in steam as well as all other vapors, are synonymous terms.

The manner in which I accomplish this is shown in plates I have exhibited before, representing a cylinder boiler, a cylindrical flue boiler, an upright tubular boiler, and "the American steam boiler," all of which are constructed on the principal that every atom of steam once formed in the water must be carried into the steam room directly, without passing through the dense medium of the superincumbent water. The result is evident. Steam is made rapidly, and the boiler contains, first, water free from steam, and second, steam free from water. In such boilers we have two agents completely separated, and even if a rupture of the boiler takes place, the result is a simple relief of pressure rapidly or slowly, according to the dimensions of the rupture, and its effect is no more disastrous than the giving way of a steam pipe, connected with and at some distance from the ordinary boiler.

That our present system or want of system in boiler construction is wrong, is plainly shown by the lamentable loss of lives caused by boiler explosions. To carefully examine all facts bearing on boilers, and lay down plain and positive rules for their construction and management, is, I hold, one of the highest duties of the Polytechnic Association. That such rules can be applied for our common safety, is as certain as that all things are, have been, and ever shall be governed by positive laws, and shall move on, now and forever, in the paths laid down for them by the Great Architect of the Universe.

Beet Sugar.

The discussion of this subject having been resumed this evening, Dr. Feuchtwanger stated that from beet ten per cent of sugar is obtained and only eight per cent from cane.

Mr. J. Wyatt Reid said he believed a more correct statement

would be fourteen per cent from cane and four per cent from beet. Mr. E. B. Grant said he knew of twelve per cent having been got from beet, the more general yield being eight and a half per cent. More sugar is produced from beet than from equal quantities of cane. In France the cost of manufacture is about from $3.20 to $3.80 per ton, and the beet is worth $3.25 per ton. To ascertain the profit of the manufacture in this country is a very simple sum: 1000 tons of beets at $4.00 per ton, and cost of manufacture $4.00 per ton—total cost for one thousand tons, $8,000; the amount of stock will produce sixty tons of sugar worth $300 per ton—total value, $18,000.

The chairman said, the gentleman who has just addressed the association has visited Europe for the purpose of informing himself on the manufacture of beet sugar. The results of his observations are embraced in a work published by Lee & Sheppard, Boston, 1866, entitled, "Beet Root Sugar, and the Cultivation of the Beet." It would gratify the meeting if the gentleman would enter more fully into the details of this manufacture.

Mr. Grant then took the floor, and the following embraces what he has said and written on the points discussed:

Cost of Beet Sugar in France.

There are various methods of making sugar from beets employed in Europe, of which the following are but a part:

The old method of rasping, pressing, treating with lime, evaporating in open boilers, crystallizing in large moulds or in pans, draining and crushing.

This method, in some factories, is modified by the introduction of the vacuum pan. In others the centrifugal machine takes the place of the slower method of moulds and of pans, for the purpose of throwing off the molasses.

In other estabishments, instead of using hydraulic presses, juice is extracted from the pulp in centrifugal machines, in which large quantities of water are used.

In others the "process of diffusion," so called, by which the beets are cut into thin slices, and the saccharine matter exhausted by steeping them in water in a series of vessels.

In others the "process of maceration" is applied to small slices of beets, called "cossettes," which are dried and then steeped in water in a range of "macerators." In others there is a single saturation with carbonic acid gas after defecation.

In others the "Maumené process," or the system of cold defecation is employed.

In others the syrup of the beets is "strengthened by the addition of sugar, and a refined loaf is produced directly from the beet.

In some establishments the old-fashioned "scum press," worked by hand, is seen, while others have "hydraulic scum presses." A score of different methods are employed in various parts of Europe for treatment of the "scum."

In my judgment, however, incomparably the best process is the system of "double carbonitation," so called, of Perier and Possoz.

This method reduces the quantity of bone-black required to a very small amount, allowing the beets to be worked later in the spring, producing a larger percentage of sugar, of better quality and at lower cost, than by any other method.

Taken in conjuction with the "hydraulic press," "Riedel's filter press," for the treatment of scums, the "carbonitation trouble," and, possibly, the "Joly rasp," it leaves little to be desired, and is the one that I heartily recommend for adoption.

In France the expense of manufacturing raw sugar, including the cost of the beets, varies from three to four cents per pound.

The average expenses of converting 1,000 tons of beets into sugar by the best processes are about as follows, not including taxes or interest on capital:

1,000 tons beets at $3.80		$3,800
Coal, 120 tons, at $3.00		360
Bone-black waste		300
Sacks for pulp, 250, at 70 cents		175
Labor, 220 men 5 days at 70 cents		770
Administration and salaries		200
Lighting		50
General expenses, insurance		250
Lime, metals, rasp blades, repairs, &c		845
		$6,750
From this is to be deducted, say 200 tons pulp at $2.50	$500	
Thirty tons molasses at $22	660	
		1,160
Leaving, as total cost of working, 1,000 tons beets		$5,590

The cost per pound of sugar produced varies in accordance with the percentage of yield, as shown in the following table :

Yield.	Sugar.	Cost per pound.
Six per cent	134,440 lbs.	$4 15 cts.
Seven per cent	156,800 lbs.	3 56 cts.
Eight per cent	179,200 lbs.	3 10 cts.

In one establishment that I visited in France, I asked in writing of the proprietor, to whom I had letters that warranted me in doing so, his percentage of sugar and molasses, and the cost of manufacturing.

This gentleman had been very successful, kept his accounts with great accuracy, and, as he manufactured by the old process, I selected him as a good representative of the old system, and asked him many questions, which he answered with great courtesy and in the fullest and most satisfactory manner. His yield of juice was eighty per cent of the beets worked ; his percentage of sugar was 6.85, and of molasses 2.75 per cent *of the juice.* This gives a result of 5.48 per cent of sugar and 2.2 per cent molasses on the beets worked, which was the poorest result with which I met.

In reply to my question as to the expense of converting a ton of beets into sugar, I shall give a literal translation of his reply, stating that the estimate was made from the business of nine years, in which time he had made improvements and enlargements of his mill, all of which were charged to expenses :

"Hand labor, general expenses, ten per cent depreciation of machinery, coal, taxes, in one word, *every* expense, even those for enlargements of works and improvements of machinery, amount to 13.75 francs the 1,000 kilogrammes of beets."

This is about $2.60 per ton of beets worked. The average price paid for beets in the above described establishment was eighteen francs the 1,000 kilogrammes, or $3.42 per ton, making the total cost of a ton of beets and its conversion into sugar $6.02. From this is to be deducted the value of the pulp and molasses:

Say, for 1,000 tons of beets at $3.42	$3,420	
Manufacturing 1,000 tons of beets at $2.60	2,600	
		$6,020
Less 200 tons pulp at $2.50	$500	
Less 22 tons molasses at $22	484	
		984
		$5,036

Yield of sugar at 5.48 per cent, 54.8 tons, or 122,752 pounds, leaving the net cost of a pound of sugar $4\frac{1}{10}$ cents.

The expense for labor at $3\frac{1}{2}$ francs, or sixty-six cents, per day (the average) was ninety-two cents per ton of beets worked, being thirty-five per cent of the cost of converting a ton of beets into sugar, and 15.2 per cent of the *total cost*, including the price paid for the beets. This, if charged entirely to sugar, would make the cost of labor in a pound of sugar six mills.

Inquiry has satisfied me that the expense of manufacturing 1,000 kilogrammes, or 2,200 pounds, of beets into sugar in France, including in the expenses taxes, interest on capital, and depreciation of machinery, averages from eighteen to twenty francs, or $3.47 to $3.87 per ton of beets. In some cases it is as low as fifteen francs, or $2.88, per ton, and in others as high as twenty-two francs, or $4.25, per ton. In the case quoted above it was 13.75 francs, or $2.60, per ton.

The expense for labor in the best establishments is, as a rule, about twenty-five per cent of the cost of *manufacturing*.

From these figures, which I know to be reliable, the cost of a pound of sugar and the proportion due to labor are shown in the following table; labor being reckoned at sixty-six cents per day and the cost of beets at $3.80 per ton; yield of molasses at two and one-half per cent, price $22 per ton; pulp twenty per cent, price $2.50 per ton.

Cost of labor and total cost per pound of converting beets into sugar.

Manufacturing cost per ton of beet.	Yield.	Cost of labor per pound.	Total cost per pound.
$2 88	6 per cent.	5 3-10 mills.	4 1-10 cents.
	7 "	4 5-10 "	3 6-10 "
	8 "	4 "	3 1-10 "
3 47	6 "	6 4-10 "	4 6-10 "
	7 "	5 5-10 "	3 9-10 "
	8 "	4 7-10 "	3 4-10 "
3 87	6 "	7 1-10 "	4 9-10 "
	7 "	6 1-10 "	4 2-10 "
	8 "	5 4-10 "	3 6-10 "
4 25	6 "	7 9-10 "	5 2-10 "
	7 "	6 7-10 "	4 4-10 "
	8 "	5 9-10 "	3 9-10 "

I know of an establishment in France where the total cost of producing sugar, exclusive of interest on capital, is but thirty-six

francs per 1,000 kilogrammes of beets, or 3 1-10 cents per pound of sugar.

The yield of sugar is about eight per cent, of which four and one-half per cent is of a quality fit for direct consumption, and would bring fifteen cents per pound here to-day. Two and one-half per cent is of a grade better than No. 14, and one per cent is equal to No. 12. In another about the same amount and quality is produced at a cost of 3 7-10 cents per pound.

I know of another establishment where the total cost, including every expense, interest on capital at five per cent, and depreciation of machinery at ten per cent, was, in 1865-6, but the fraction of a mill over four cents per pound.

The amount of sugar produced was seven and one-half per cent; but the quality was not so good as in the previously described cases, although the first quality, which amounted to four per cent of the beets worked, sold readily at seventy-five francs the hundred kilogrammes, or six and one-half cents per pound.

Profits on Beet Sugar.

It is believed that the only material item of expense in the manufacture of sugar that would be greater in the United States than in France is the single one of labor. All others in excess of those of France are here more than offset by the lower cost of coal, of land, and of taxation.

In relation to labor it is well known that in the United States the use of labor-saving machines is greater than in any other country, because the high price of labor has stimulated their invention. It is a fact that the number of hands employed in sugar *refineries* in this country is much smaller than in European establishments of the same capacity of production, and it would doubtless be possible to effect some saving in that direction as compared with France in an American sugar *manufactory*.

The labor in a beet-sugar factory in this country would certainly not require a greater number of men than is required in a similar establishment in France. But, assuming that the same number would be necessary, it is proper to ascertain the exact relation that the price of labor bears to the cost of production.

In Europe the number of skilled hands required in a sugar manufactory is very small, the great proportion of workmen being common farm laborers, who work in the fields in summer and in the mills in winter. The making of beet sugar is only carried on

in the fall and winter months, say from October to February. With us, by reason of a more favorable climate, not only for the earlier development, but also for the better preservation of the beet, it could be extended from September to March, or even later. It will be acknowledged that these are the months in which labor in this country can be most readily and reasonably procured. The probability is, inasmuch as the establishment of this industry in Illinois would permit the hiring of men by the year, that the price of labor per day would average considerably less than it does at present in the summer time, which, in the region I have selected, is about one dollar and fifty cents per day for a first-rate hand.

One of the first merchants and manufacturers of France told me that, with wages at three and a half francs per day, the value of labor in a hundred kilogrammes of sugar should not exceed four to four and a half francs. That is, with wages at sixty-six cents per day, the cost of labor should be less than four mills per pound.

By the preceding tables the cost of labor at sixty-six cents per day varies in a pound of sugar from four to seven and one-tenth mills in France. The average is not far from five and eight-tenth mills per pound.

If the same amount of labor be required here as the average of France, and its value be three times greater, or two dollars per day, then the average cost of a pound of sugar from beets, yielding seven per cent, will be five and one-fourth, instead of four cents, per pound.

I herewith present a table showing the results that, I have no doubt, can be obtained in Illinois by a company with $300,000 capital, of which $200,000 shall be appropriated for buildings and machinery, and $100,000 reserved for working capital.

Expenses.

Twenty-four thousand tons of beats, at $4.00	$96,000
Labor, 225 men, 150 days, at $1.75 per day	50,625
Salaries	10,000
Coal, 3,000 tons, at $1.50	4,500
Sacks for pulp, 8,000, at $1.00	8,000
Bone-black waste	7,500
Insurance	2,000

Lighting	$750
Lime, metats, barrels, rasp blades, repairs, &c.	15,125
	$194,500

Receipts.

1,680 tons sugar (yield calculated at seven per cent), at $200 per ton, or eight and nine-tenth cents per pound	$336,000
720 tons molasses (yield calculated at three per cent), at $10.00 per ton, or four cents per gallon	7,200
4,800 tons of pulp, at $2.00 per ton (equivalent to hay at $6.00 per ton)	9,600
	$352,800
Less expenses	194,500
Profit equal to fifty-two per cent on capital	$158,300
From which is to be deducted for local taxes and internal revenue	10,000
Net profit, being nearly fifty per cent on capital	$148,300

It will be seen that the yield of sugar is placed at seven per cent. I have no doubt it would be more, for by the method recommended, and which is in use in France, the yield is eight per cent. The price of sugar is also calculated at eight and nine-tenth cents per pound, but samples made by the process referred to are declared to be now worth an average of thirteen cents.

The value of the molasses I have placed at four cents per gallon, but it will produce twenty-five per cent. of its weight in 90° alcohol, and the market value of a material that will give that result is certainly not less than twenty-five cents per gallon.*

I have placed the market value of the pulp at two dollars per ton, at which price it has been ascertained, by years of experiment, to be equivalent to hay at six dollars per ton; therefore it cannot be said that the estimate is too high.

On the other hand, beets are charged at four dollars per ton, upon which there is little doubt a saving of fifty cents per ton, or

* The molasses contains from forty-five to fifty-five per cent. of crystallizable sugar. Until recently no economical method for its extraction was known. Last year, however, three or four establishments were erected in Europe for that purpose, and I have been assured that nearly all the sugar can be extracted at a cost of three and a half cents per pound.

twelve thousand dollars, could be effected. In my publication the probable cost of beets is discussed. There can be little doubt that the actual cost to the farmer will rarely exceed three dollars per ton, even with small crops, while with twenty or thirty tons per acre, the larger of which is by no means an uncommon yield, the cost would be from one dollar and a half to two dollars a ton. Manufacturers could certainly raise their own beets at three dollars per ton, and probably at considerable less.

In fact, there can be no doubt that the estimated expenses are placed sufficiently high, being at the rate of four and nine-tenth cents per pound of sugar, or one and eight-tenth cents higher than in the French manufactory, which it is proposed to copy; while excluding the item of labor, the balance of expenses would be less here than in France. The actual expenses for labor in the French manufactory are less than one-half a cent per pound, and one and eight-tenth cents per pound has been allowed as the excess of cost here over that in France.

I present below a table showing the estimated result, with the yield of sugar as great as in the French establishment, namely, eight per cent., provided it were sold at its present market value, say twelve and a half cents per pound, and the molasses at twenty-five dollars per ton, or ten cents per gallon, which is less than half its actual value for distillation.

1,920 tons of sugar at 12½ cents per pound	$537,600
720 tons of molasses at $25.00 per ton	18,000
4,800 tons of pulp at $2.00 per ton	9,600
	$565,200
Less expenses	194,500
Profit (equal to 123 per cent on capital)	$370,700
Or, deducting taxes and internal revenue	16,000
118 per cent.	$354,700

By the poorest methods prevailing in Europe six per cent. of sugar is obtained. By the best processes nine per cent. of sugar and two and a half per cent. of molasses can be and repeatedly have been extracted from beets containing twelve and a half per cent. of saccharine matter, which is the amount in the beets raised in Illinois on the first experiment. I submit, therefore, the accom-

panying table as an indication, on the one hand, of a result that is *possible to be realized*, and also, on the other, of a result that in the present state of the art is certain to be at least *equalled*.

In this table sugar is credited at ten cents a pound, molasses at ten cents per gallon, and pulp at two dollars per ton. Expenses are reckoned as in the preceding table on page 782.

TABLE *showing the products of sugar from* 24,000 *tons of beets, yielding six, seven, eight, and nine per cent., with the amount and percentage of profit on a capital of* $300,000. *Taxes and internal revenue not deducted.*

Yield per cent.	Yield of sugar. } tons.	Profit.	Profit, per cent.
6	1,440	$152,660	$50\frac{8}{10}$
7	1,680	206,420	$68\frac{8}{10}$
8	1,920	260,180	$86\frac{7}{10}$
9	2,160	313,940	$104\frac{6}{10}$

In my estimates I have discussed fully the probable cost of manufacturing beet-root sugar, and have arrived at the conclusion that under no circumstances, with a yield of seven per cent. of sugar, can the cost exceed five and a quarter cents per pound. My belief is that it would be less, say four and three-quarter cents at the outside. But if it cost five and a quarter cents, and sold at ten, there would still be a profit of ninety per cent.

After making all allowance for contingencies that I can imagine as possible to arise, I have not the slightest doubt that there can be realized on the manufacture a profit of at least eighty per cent. on the capital invested.

In a conversation with a French gentleman, a manufacturer of sugar machinery for all parts of the world, and who is also largely interested (and with most favorable results), in the manufacture not only of cane sugar in Martinique, but also of beet sugar in France, in Germany, in Poland, and in Russia, he gave it as his opinion, that the beet was destined to become the great sugar-producing vegetable of the world, for the reason that it can be cultivated in the temperate latitudes, in countries of dense population, and consequently in close proximity to the consumers of sugar. In his judgment sugar can be produced from it as cheaply in Europe or in the United States as it can be from cane in the West Indies or Brazil. And even if that position were not tenable, the expenses of transportation are so great as to render it absolutely certain that sugar produced from the cane cannot com-

pete with beet sugar in the markets of Europe or the United States.

The "Journal des Fabricants de Sucre" says, that "the season of 1865–6 developed the success of two highly important processes, namely, the immediate carbonation without defecation of the juice as it came from the press, and the perfection of the operation of the improved filter presses. In the factories, where these new methods were employed, their superiority was marked in comparison with the old system, by which, late in the season, it was almost, and oftentimes quite impossible to make good sugar. Beets that could not be successfully worked by the old process were brought to the new establishments, where sugar of beautiful quality, fit for direct consumption, was readily produced. And what was still more remarkable, in as great proportions upon the amount of beets worked as in the beginning of the season."

The entire success of these processes, which, seeing in operation, I have recommended the adoption of, has created the greatest excitement among the manufacturers in France. The opinion is there entertained that their employment will not only increase the average yield of sugar at least one per cent. on a hundred pounds, but also improve the quality of the sugar several numbers.

The remarkable results produced by these improvements have attracted the attention of Englishmen; and the probability is, that the manufacture of beet sugar will yet be established in Great Britain, the country that not only tried to strangle the industry at its birth, but also, when it had been successfully established on her own soil, gave notice to the manufacturers, through its government, that an excise of five cents per pound would be placed upon their production, upon the ground that it would interfere with the prosperity of their West India possessions!

Production of Sugar in Various Countries.

Ramon de la Sagra, in his work "Cuba en 1860," states that the average production of sugar per acre from the cane in that island was .... 1,709 lbs.

The highest	7,980 "
The lowest	1,257 "
Martinique average	1,587 "
do highest	1,900 "
Porto Rico average	3,950 "

Reunion lowest	1,100 lbs.
do highest	9,625 "
do average	3,200 "
Mauritius	8,562 "
Java	4,166 "
I will add that the product in Louisiana before the war was about	1,100 "
In Germany the average production from beets is about	2,100 "
In France, average	2,200 "
do highest	5,000 "

It will thus be seen that an acre of land produces from beets a larger average amount of sugar in France and Germany than is produced from cane in Cuba, Martinique or Louisiana. In Mauritius the system of cultivation is good, but it is a matter of notoriety that the sugar of Mauritius cannot compete with beet sugar in France, notwithstanding it has an advantage over the latter, in the French ports, of five francs the hundred kilogrammes, or 4.3 mills per pound.

M. De la Sagra gives the following figures, showing the amount of sugar produced to a "hand" upon several of the best plantations in Cuba:

La Ponina	4,238	Flor de Cuba	6,430
Conchita	4,413	Delto	7,062
St. Martin	4,512	Las Canas	13,327

On some well-ordered estates, both in France and in Germany, the production of sugar to a "hand" exceeds 14,000 pounds.

The production of sugar at Martinique in 1832 was 30,000 tons. In 1850, in consequence of emancipation, it fell to 15,000 tons. In 1864, the production again reached 30,000 tons. Emancipation produced a similar result in Guadaloupe. In Reunion, by reason of immense importations of Coolie labor, production has increased fourfold since emancipation; but intelligent observers see that Coolie labor is but another form of slavery, for which reason the supply must cease. It does not, like slavery, reproduce laborers, for ninety to ninety-five per cent of the Coolies are males. The increased production is also due to an extended area of cultivation, and not, as in Mauritius, to improved methods of culture. In fact, some of the most intelligent planters in several of the French colonies have abandoned sugar cane, and cultivate other crops.

ATTEMPTS TO MANUFACTURE BEET SUGAR IN THE UNITED STATES.

Several attempts on a very small scale have been made, within the last thirty years, to manufacture beet sugar in this country; but with one exception, so far as I can learn, they were made when the industry was in its infancy, and when prices were much lower than they are at present, or are now likely to be.

Those attempts were not crowned with commercial success; but the results produced were such as to demonstrate, beyond the shadow of a doubt, that beet sugar can now be made in this country with the most absolute certainty of success.

The attempt, of which there is now to be obtained the most complete published account,* was made at Northampton, in the valley of the Connecticut, in the years 1838–9, by David Lee Child, and the "Northampton Beet Sugar Company." The company were the successors of David Lee Child, to whom the Massachusetts Charitable Mechanic Association, at their second exhibition, in 1839, awarded a silver medal.

In their report the Association say, "The crude or raw sugar is well made, dry, and of good grain. The refined shows that this article can be made of as good quality as sugar from the cane."

On the 5th of December, 1839, the "Massachusetts Agricultural Society" awarded a premium of one hundred dollars to the "Northampton Beet Sugar Company," for beet sugar.

On the 13th of November, 1839, Hon. Levi Lincoln, president of the "Worcester County Agricultural Society," addressed a letter to Mr. Child, who had sent him a box of sugar for exhibition. The box arrived too late; but the following extract from Mr. Lincoln's letter indicates the quality of the sugar: "Availing of your kind permission, samples of the sugar were submitted to the inspection of several gentlemen. The *brown* sugar was found to be pure, very sweet, and entirely free from any bad taste, and its quality, in every respect, was highly satisfactory.

"The refined or lump sugar seemed not so well granulated as is desirable. Still we are well satisfied that, as an experiment in the manufacture, it is highly encouraging, and we all felt that the country was largely indebted to your intelligence and enterprise in demonstrating, beyond all question, how entirely this application of domestic industry is at her command."

In May, 1839, Mr. Child received a letter from Martial Duroy, of Boston, confectioner, from which the following is an extract:

* The Culture of the Beet, and Manufacture of Beet Sugar, by David Lee Child, 1840.

"Having, while in France, heard the confectioners in general deprecate the use of beet sugar in their work, I was naturally a little prejudiced against it when I was called upon by you to make some confectionery for the 'Ladies' Anti-slavery Fair.' I was pleased to find, upon trial, that your raw sugar was extremely easy to clarify, and that it grained freely. These attributes of good and pure sugar reconciled me at once with it, and I made a variety of confectionery as easily and as handsomely as with the best Havana. But its power of crystallization is particularly interesting, as it is upon this that depends its successful transformation into loaf sugar; and as far as a pretty considerable experience goes to establish it, I think beet sugar obtained by your process does crystallize both easily and abundantly, forming at will coarse or fine grains, peculiarly brilliant, and giving by far a smaller quantity of molasses in the process of refining than cane sugar of a corresponding quality. I found also the molasses of a pleasant taste, and well adapted in its chemical composition to culinary purposes."

Mr. Child says that the best result he obtained from one hundred pounds of beets was seven pounds of sugar and three and one-third of molasses; that "the sugar was of excellent quality, free, even in its raw state, from any bad taste, and of a pure and sparkling white when refined. Old and extensive dealers have pronounced it in both states capable of successful competition with any sugars in the market."

The quantity made was about 1,300 pounds.

Mr. Child satisfied himself, from the result of the labors of 1838–9, that "the raw sugar can be obtained without any bad taste, and fit for immediate consumption; that American beets, though generally inferior to the European in saccharine richness, can, by suitable culture, be made inferior to none."

He says: "The sugar grained in a few hours, drained well, and is not inferior in flavor or appearance to the finest West Indies Muscovadoes. The quality of the molasses has been a matter of utter surprise to us. In France the molasses is considered of no value except for feeding to animals or for distilling, and it sells for four or five cents per gallon. The molasses from the sugar in question is of a bright amber color, and so pure and pleasant as to be preferred by many to any but sugar bakers." He says: "It will be readily conceived that a small establishment, dependent upon farmers for material, paying for it twice the cost of its pro

duction, and executing by hand several heavy and tedious operations, which ought to be performed by steam, water or horse power, cannot furnish accurate data for determining the expense of making beet sugar. The actual cost, when the material was good, has been eleven cents per pound, the pulp and manure not taken into account. We are of opinion that, with proper and sufficient means, beet sugar may be manufactured in the United States at four cents per pound. When the manufacture shall have become domesticated among us, it will probably be produced at a cost less than that."

In relation to the effect of a beet crop on succeeding crops, Mr. Child says: "In Northampton, wheat has succeeded beets the present season with rather striking success. A farmer let a field abutting on Connecticut river on shares. On a part of it he raised beets last year, and on the other Indian corn. The whole was equally manured. The corn yielded seventy-five bushels to the acre, and the beets were tolerably weeded. The wheat was harvested, and his share delivered in the barn without any attention to it on his part. In due time a laborer was employed to thrash it. This person, after thrashing a quantity, observed to his employer that the wheat on one side of the loft thrashed easier, and had a better berry and brighter straw, than on the other. Upon examination, it was found that the former had been produced upon the beet, and the latter upon the corn, section of the field, but with this difference, that the beet grew nearest to the river, where it is considered that wheat is most likely to blast. We had the advantage of examining these wheats, and the difference was clearly such as the thrasher had stated. The proprietor found a difference of three and a half pounds per bushel in the weight. We presume that the difference in the flour would be found much greater, because the grains of the inferior wheat being smaller, it would require more of them to fill a measure; and as the shrunk grains have the same quantity of skin as the large, and as it is the skins which make bran, it follows that the superiority remarked would appear still more signally if the two samples were ground and bolted."

Mr. Child, in a note, remarks: "Mr. Harrison O. Apthorp, of Northampton—one of the earliest cultivators of the sugar beet in this country—has informed us of the remarkable growth of herds-grass as a successor of sugar beets on his grounds. The crop was

pronounced by the oldest farmers in Northampton village superior to any of the kind they had ever seen in the meadows."

Several years ago beet sugar, of very fine quality, was made by the society of Shakers, at Enfield, but upon too small a scale, and by too crude a method, to ascertain fairly the price at which it could be produced.

In 1863-4, the brothers Gennert, of New York, conceived the idea of manufacturing beet sugar. Mr. Thomas Gennert visited Europe for the purpose of studying the methods there employed. Upon his return, the firm selected the prairie lands in the town of Chatsworth, Livingston county, Illinois, purchased 2,300 acres, erected buildings, and commenced the cultivation of beets. In process of time they gathered their crop, which, owing to the drought, and also to the unfavorable method of planting, yielded only ten or twelve tons to the acre. The beets were of excellent saccharine properties, containing twelve and a half per cent. in sugar. The heavy outlay required exhausted their means; or, to use their own words: "We started on too large a scale for our purse, which gave out too soon, before the machinery, which was required for a successful working, was finished; but experience has shown us sufficiently that sugar enough is contained in the beets, and that it can be got out. With our imperfect or rather incomplete machinery, we extracted seven per cent. in melado. Those beets would average, with complete machinery, nine per cent."

The Messrs. Gennert have put their property into a stock company, called the "Germania Sugar Company," and have six hundred acres of land in cultivation with beets this season.

I submit their estimate of the profits of working one hundred tons of beets per day, with the following productions of sugar on a capital of $200,000:

At 6 per cent	73 per cent profit.
At 7 per cent	91 per cent profit.
At 8 per cent	109 per cent profit.
At 9 per cent	127 per cent profit.

General Advantages of Beet Sugar Manufacture.

The "Journal des Fabricants de Sucre," in its issue of December 8, 1864, says: "We find that the abolition of slavery in America and the West India Islands, which seems to us the inevitable result of the America war, at the same time that it increases

the demand for sugar must diminish the supply about 500,000 tons. The production of Louisiana will be destroyed, that of Cuba diminished one-half or one-third, and that of Brazil will be reduced. How is this deficiency to be supplied? The consumption of the United States is nearly as large as that of Great Britain, and they will probably be driven by necessity to manufacture sugar from the beet, the processes for which they can learn of Europe. As for France, Belgium, and Germany, they can easily double or triple their production; for it does not require long preparation of the soil to produce beets. Capital is abundant for such an enterprise; and even at the present rate of increase, production doubles every ten years."

"England may fear that the manufacture of beet sugar in Great Britain would prejudice her colonial interests; but some of her statesmen foresee its introduction." The editor predicts that the effect of the change in the sources of supply would be to diminish, and not to enhance, the price of sugars. He goes on to say, "The North and the South may fight as long as they like. The 4,000,000 slaves in the Southern States may be freed, the 400,000 negroes in Cuba may also be emancipated, as well as those of Brazil. The African slave trade may stop, drought and insects may continue to ravage the sugar plantations of Reunion and Mauritius, but sugar will not become scarce in Europe for all that. We shall continue to be supplied by our own admirable industry, whose advantages and development we have set forth."

In a later issue the probability is discussed of the United States continuing to import annually 300,000 to 400,000 tons of sugar from Cuba and Brazil, "when they have the ability to supply all their wants with beet sugar from their own soil, not only with certainty of profit to the manufacturer, under the existing tariff, but also with advantage to the whole country, because of the unreliability of the cane crop of Louisiana, which never ripens, and which at any rate is certain to be paralyzed for the next ten years.

"But even if the duties on foreign sugars should be abolished, the advantage would be on the side of the beet-sugar manufacturer, who will probably have less need of protection than the Louisiana planter.

The people of the Northern States will not long defer the cultivation of a plant which contains so much sugar that it will soon teach them to forget that which was formerly produced upon the

banks of the Mississippi. As to the competition of Cuban and Brazillian sugars, they have no more cause to fear it than have the beet-sugar makers of France and Germany, where the economical conditions are far less favorable than those of the Northern and Western States."

The beet-sugar industry has been of vast benefit to Europe. Notwithstanding the high protective policy to which it owes its existence, and which, as a matter of course, was pursued for a time at the expense of the public, which paid higher for sugar than it would otherwise have done, yet there is no question that sugars have been cheaper throughout the world for the past fifteen years than they would have been had the industry not existed.

Formerly the production of sugar was a monopoly confined to the tropics, where its possession, combined with the cheapness of land and the system of slavery, fostered in planters and manufacturers an extravagant, shiftless, and costly method of manufacture.

The vast improvements that science has brought to bear on the chemistry and mechanics of beet-sugar production in Europe have awakened the planters and manufacturers of the tropics to the necessity for progress, if they desire to retain their supremacy.

Almost all the improvements made in cane-sugar manufacture in the last fifteen years, owe their origin to the beet-sugar establishments of France and Germany.

The effects produced upon agriculture in Europe by the cultivation of beets for sugar and alcohol have been astounding, and the importance of the interest is now everywhere acknowledged.

In the cane-sugar countries upon the territory surrounding a a sugar establishment no crop is to be seen but the cane, while cattle and sheep are few. In the sugar districts of Europe, on the contrary, the fields in the vicinity of a sugar manufactory are covered with the greatest diversity of crops, among which are beets, wheat, rye, oats, barley, corn, rape, flax, tobacco, and all the cultivated grasses. Every field is cultivated close up to the road-side, and the stables are filled with fine cattle, sheep, horses and swine.

No farmer needs to be told which system is the best and most enduring.

M. Dureau, author of several valuable works on beet sugar, and also the editor of the "Journal des Fabricants de Sucre" says, "The cultivation of the beet is getting to be highly popular.

"The president of an agricultural society, is sure to gain all hearts when he talks about beets. No agricultural newspaper can

abstain from entertaining its readers with accounts of the precious plant, and there is no farmer who does not introduce it into his fields with the view of its conversion either into sugar or alcohol. Everybody sings its praises; and surely none have a better right to join in the concert than we, who have always been its advocates for the sake of the industry with which it is allied."

A French writer, after having demonstrated the importance of the beet-sugar industry to agriculture, in urging its extension, says: "Who would believe that England, with her poor soil, her wet climate, and her pale sun, could produce crops of grain double ours, and that the yield of her fields surpassed that of the luxuriant plains of Lombardy? The perfection of her agriculture explains this wonderful production. So does the progress of the manufacture of beet sugar explain how the cultivator of the north can extract as much sugar from a hectare of his cold and wet land, as the indolent Creole from the rich soil of the Antilles, bathed in sweet odors and in sunshine."

The basis of the agriculture of England is the turnip. In the best cultivated districts of France, it is the beet. M. Barral, a celebrated writer on agriculture, says, "I did not find any good crops except in those countries where an industrial culture prevailed, which is especially the case in those where the beet is cultivated."

Another writer says, "Of all species of industry which it is desirable to see extended in France, the manufacture of sugar and alcohol occupies the first rank. Branches of industry which are pursued in the winter deserve to be supported, because they give employment to laborers who work in the fields in the summer, and thereby enable them to increase the amount of their yearly wages."

Another writer says, that "all cultivators and economists are unanimous in recommending the cultivation of the sugar-producing plant, which is the source of deep tillage, heavy manuring, and increased production. No one believes now that it exhausts and impoverishes the soil, or that it hurts other crops: these are the prejudices of a by-gone age, which science and practice have banished, to set up in their place a recognition of benefits of the highest order produced by the culture of the beet."

M. Dureau says, "The manufacture of beet sugar was formerly charged with being a local industry. To-day it no longer deserves that reproach, for it is not alone in the north of France that it is

pursued; but it has penetrated into the east, the west, and the south,—into Germany, Russia, Italy, Austria, Spain—everywhere."

Another says, that "everywhere the beet is cultivated in France, land advances in value, and the wages of workmen take the same direction."

"All Europe, though France has contributed the largest and most glorious part towards the accomplishment of the result, is destined to become a great sugar-producing country, not less important than those where they cultivate the cane, which many believed to be the only plant suitable for the production of sugar, that precious food, of which people of the present age are such large consumers. Why should not sugar, which the mysterious forces of nature have secreted in the beet, be extracted from it, and the soil, prepared for new harvests, and rendered doubly fertile by the thorough cultivation it demands, furnish increasing quantities of food for man, and for beast? It is the triumph of industry."

L'Echo Agricole says, that "all farmers who obtain first prizes at the agricultural exhibitions are either sugar manufacturers, distillers. or cultivators of the beet. Those who have adopted this branch of agriculture, either as proprietors or tenants, have really obtained astonishing results. They would be surprised if they did not carry off all the first prizes at the public exhibitions, and were consequently mentioned in the official reports of the government."

M. Vallerand, who took the first prize in the Department of Aisne, bought, in 1853, a farm of eight hundred and thirty-two acres, the sales of produce from which amounted to $8,000. In 1859 it produced $41,200. M. Dargent, who took the first prize in the Department of Seine Inferieure, cultivated only fifty acres. He so increased the production of this farm that he obtained 154,000 pounds, or 68 tons and 168 pounds, of beets from a single acre. His yield of wheat was 43½ bushels, and of oats 59½ bushels, to an acre.

M. Hary, Pas de Calais, obtained from two hundred and ninety-five acres 5,225 bushels of wheat, 2,500 tons of beets, and fattened 150 head of cattle.

The culture of the beet involves the necessity of deep ploughing, heavy manuring, and thorough weeding. The pulp from which the juice is extracted in the manufacture is an excellent food for cattle, the number of which has been increased, in the districts

devoted to that industry, from eight to ten fold since the introduction of sugar-making.

The cattle furnish an immense amount of manure, which, applied to the deeply-ploughed and well-weeded beet lands, enhances their productiveness for the cereal crops.

In 1853, when the emperor and empress came to Valenciennes, a triumphal arch was erected, with the following inscription:

SUGAR MANUFACTURE.

Napoleon I. who created it.—Before the manufacture of beet sugar, the arrondissment of Valenciennes, produced 695,750 bushels of wheat, and fattened 700 oxen.

Napoleon III. who protected it.—Since the manufacture of beet sugar was introduced, the arrondissement of Valenciennes produces 1,157,750 bushels of wheat, and fattens 11,500 oxen.

The brothers Fievet have a model farm of 552 acres at Masny, which is considered the best in France. They are sugar manufacturers, and fatten 800 head of cattle and 3,000 sheep every year. I visited there last winter, and spent a day in their manufactories and on their farm. They attribute their success as cultivators to the immense amount of manure that the beet pulp enables them to make, to the improved condition of the soil, and also to the increased amount of profitable service of the land, consequent upon beet culture, no fallows being required.

They have cultivated the farm for thirteen years: the crops are beet, wheat, oats, rye, and hay. I shall give some of the results of the eleven years preceding 1864. The average amount of land in oats had been thirty acres. In 1853 the crop was 45½ bushels, in 1862 nearly 92¾ bushels, and the average for the whole time within a fraction of 70 bushels to the acre.

The crop of straw increased in like proportion, and averaged two tons to an acre. In 1863 it was nearly three tons.

The crops of rye improved in a still greater ratio—increasing from 17 to 34½ bushels per acre, averaging nearly 30 bushels, with two tons of straw to the acre.

The average crops on 156 acres of wheat had been over 36½ bushels to the acre.

Parts of the land had sometimes produced 67⅝ bushels to the acre, and no portion had ever yielded less than 20½ bushels. The yield of hay had been over three tons; and of beets twenty tons to an acre.

In 1865, thirty, thirty-five, and even forty tons of beets were raised on an acre.

As to the cost of producing these crops, the Messrs. Fievet stated that the thorough cultivation of the ground for beets reduced the cost of cultivating succeeding crops enormously.*

Thus, after deducting the proceeds of the straw, their oats cost them less than thirty cents, their wheat less than sixty cents, and their rye less than thirty-eight cents per bushel.

This they attribute to underdraining, to the use on the beet crop of lime, either pure or the carbonate of lime from the filter presses of the factory, to the liberal application of other manures, to deep plowing, thorough weeding and cultivation. The grain crops are not manured, and the ground is so thoroughly prepared by the beet for succeeding crops, that a single light plowing suffices for the grain, which is all sowed in drills by a machine.

Before the introduction of sugar industry into France, workmen in the country, by reason of a lack of employment, were so constantly emigrating to the city, that government instituted inquiries to ascertain the cause, and also the best method of preventing it. Now, the natural tendency of workmen to seek the capital is not noticed in the sugar-producing districts, where the industry gives ample and well paid employment to all, both in summer and in winter, and where crime and pauperism have sensibly diminished.

Agriculture was looked upon as the calling of peasants, requiring little intelligence and no education. It is far otherwise now; and to be successful as a farmer, involves the necessity of having a good education. The introduction of sugar making into France,

* The subjoined table shows approximately the average yield of certain crops per acre in twenty-three of the United States, in the year 1865, according to the Report of the Department of Agriculture for January, 1865:

Crops.			Highest average yield.		Lowest average yield.	
Wheat	$13\frac{1}{2}$	bush.	Minnesota	$20\frac{3}{4}$	Kentucky	$7\frac{1}{4}$
Rye	15	"	Kansas	24	Delaware	7
Barley	$23\frac{3}{4}$	"	Vermont	$28\frac{3}{4}$	Massachusetts	$19\frac{1}{2}$
Oats	$21\frac{3}{4}$	"	Minnesota	$41\frac{1}{2}$	Delaware	12
Corn	$36\frac{1}{2}$	"	Nebraska	$46\frac{1}{2}$	Delaware	$16\frac{1}{2}$
Buckwheat	$19\frac{1}{4}$	"	Nebraska	$26\frac{2}{3}$	Delaware	$10\frac{1}{2}$
Potatoes	113	"	Minnesota	197	Kentucky	$59\frac{1}{2}$
Tobacco, 16 States	906	lbs.	Connecticut	1,350	Kansas	533
Hay	$1\frac{1}{2}$	tons.	Nebraska	2	Maine	1
Sorghum molasses, 18 States	$110\frac{3}{4}$	gals.	Kansas	129	New York	75

The productions of the farm at Masny vastly exceed those of the States named. The explanation is to be found, not in the soil or climate, but solely in the cultivation.

and the intimate relation between that industry and agriculture, called for improved methods of culture, and a more intelligent and scientific application of labor. Intelligence and education were decentralized for the benefit of the whole country; capital also lent its powerful aid, and agriculture made rapid progress, while the condition of the laborers was also materially improved.

Louis Napoleon, the present Emperor of the French, when he was imprisoned at Ham, in 1842, said of the beet sugar industry in his "Analyse de la Question des Sucres:" "It retains workmen in the country, and gives them employment in the dullest months of the year; it diffuses among the agricultural classes good methods of culture, calling to their aid industrial science, and the arts of practical chemistry and mechanics. It multiplies the centres of labor. It promotes, in consequence, those sound principles upon which rest the organization of society, and the security of governments; for the prosperity of a people is the basis of public order. * * *

"Wherever the beet is cultivated, the value of land is enhanced, the wages of the workmen are increased, and the general prosperity is promoted."

In another place the same author puts the following words in the mouth of the sugar industry: "Respect me, for I improve the soil. I make land fertile, which, without me, would be uncultivated. I give employment to laborers, who otherwise would be idle. I solve one of the greatest problems of modern society. I organize and elevate labor."

The conclusions to which I have arrived are,—

That the skill, which is the result of the experience of more than a century, and which has made France independent of foreign countries for her supply of sugar, is available for us to-day.

That the manufacture of beet sugar can be successfully transplanted from France to the United States.

That sugar can be produced in this country from the beet nearly if not quite as cheaply as it can be from the cane in Cuba, or any other country.

That the protection of transportation alone is sufficient to render it impossible for the sugar of tropical climates to compete with beet sugar in the United States.

That as the climate of the southern States does not permit the cane to ripen, and as the yield of sugar from unripe cane is com-

paratively small, it is impossible to make sugar from cane in the United States so cheaply as it can be made from beets.

And that at present prices beet sugar can be manufactured in this country at a profit of from eighty to one hundred per cent.

By the new internal revenue law beet sugar enjoys a protection over the sugar of the cane of from one to two cents per pound in currency.

Duties on foreign sugars are from three to four and a half cents per pound in gold.

The necessities of government, and the very apparent advantages arising from introducing the manufacture of beet sugar into this country, render it probable that the protection now accorded will be maintained for the present.

The cost of transportation from the seaboard to Illinois is an additional protection on sugar raised in Illinois of about one cent per pound.

The amount of beets raised in France in 1865 could not have been, on 297,000 acres of land, less than 5,000,000 tons, producing at least 1,000,000 tons of pulp—an amount sufficient to feed 90,000 cattle or nearly 1,000,000 sheep for one year, or to fatten in the winter months nearly three times that number. It also furnished agriculture with more than 1,500,000 tons of manure. In an agricultural point of view, the effect produced by the culture of so much land in beets, and the application of the manure of so many cattle, with the consequent increase in the amount and value of subsequent crops, is perfectly apparent. The quality of wheat raised after beets is better than that usually produced; the ears are larger and heavier, the straw stronger, and not so liable to lodge. The berry is larger and brighter; its specific gravity is also greater, weighing from two to three pounds per bushel more than ordinary wheat.

But these effects are not all, even of those having an agricultural bearing, which the great industry produces. They are not confined to the comparatively narrow circle that surrounds the factory, in which are expended for beets and for labor large sums that foster industry, and scatter plenty in the surrounding villages. The distribution of these large amounts for labor and for the crop opens a better market for the productions of other branches of industry, agricultural, mechanical, manufacturing, mining, and commercial.

To till the land and consume the pulp, many horses, as well as

vast numbers of cattle and sheep, are required. These are purchased from other sections, for the departments in which the beet is cultivated are not *grazing* districts in which cattle are *raised*, but they are preëminently distinguished for *supporting* and *fattening* cattle.

The improved condition of the 70,000 laborers engaged in this industry, one fifth of whom are women and children, makes them larger consumers of tea, coffee, meat, clothing,—of all the necessaries of life. Their enlarged means place within their reach many hitherto unattainable luxuries.

The industry also calls into existence many establishments for the manufacture of agricultural tools. It gives employment to chemists and engineers; to machinists, founders, carpenters, blacksmiths, coppersmiths, wheelwrights, and plumbers; to woolen and linen manufacturers for the sacks it requires. It is a large confumer of coal, of iron, and of other metals, products of the mine. It contributes largely to the support of railroads and canals. It adds its quota to the extension of commrrce. Finally, it pays to government an excise tax on sugar and alcohol of more than $27,-000,000 per annum, without taking into account other taxes, state and local, that are assessed on the $45,000,000 that it has invested in buildings and machinery.

It has not only added immensely to the extent of arable land, but has largely increased the productiveness and value of that already cultivated. It has enabled France to produce more corn at less cost than she ever did before, and kept down the prices of of all grains, of beef, and of mutton. At the same time it produces for man sugar, meat, bread, alcohol, potash, and soda; it furnishes nutritious food for cattle, sheep, and swine, together with hay and grain for the horse. In the opinion of eminent French statesmen, it has twice, within fifteen years, saved France from a famine.

The historian Thiers has called it "the Providence of the empire."

Effect of its Introduction into the United States.

The effect of its introduction into the United States would be to produce results correspondingly greater than have attended it in Europe, for here the consumption of sugar per capita is nearly four times greater, and the value of lands is not a quarter of those in continental Europe, while they are by nature far richer and more easily cultivated. The supply of coal is unlimited. The

vast distances over which many farmers are obliged to transport their produce render it oftentimes impossible to dispose of their more bulky crops at a profit. The introduction of sugar-making would give them another and most profitable crop, for which they would have a home market. It would enlarge the local demand for other farm produce by interspersing a manufacturing with an agricultural population, to the great advantage of both. It would go far to change the present wasteful and necessarily unenduring system of agriculture, and to substitute for it another, founded upon more correct principles—a system of self-sustaining and improving, rather than suicidal and degenerating.

The gold value of sugars imported into this country is nearly $80,000,000 per annum.

The annual consumption of sugar in the United States before the war was over 450,000 tons.

There is no doubt that within twenty years it will be more than 1,000,000 tons, for with the customary increase of population and the consumption per head that existed before the war, that amount would be required.

With a proper rotation of crops the production of that amount of sugar involves the cultivation of 4,000,000 acres of land, of which 1,000,000 would be in beets, the base of the system. It would give employment the year round, in the fields and in the mills, to more than 125,000 men, women, and children. It would require $100,000,000 to be expended in buildings and machinery. It would disburse annually $100,000,000 for labor and materials. It would require each year more than 1,500,000 tons of coal. It would fatten every year 400,000 head of cattle, or 4,000,000 sheep.

There is hardly an interest that it would injure, while it would be difficult to find one that would confer so many, so great, and so general advantages upon the country. It is destined to become one of the most important branches of national industry.

At the conclusion of Mr. Grant's remarks the Association adjourned.

AMERICAN INSTITUTE POLYTECHNIC ASSOCIATION,
February 21, 1867.

Prof. S. D. Tillman in the chair; Mr. T. D. Stetson, Esq., Secy.

The chairman said he could not open the proceedings without paying a brief tribute to the memory of the distinguished scientist,

whose remains passed through our city yesterday on the way to their final resting place. Alexander Dallas Bache stood in the foremost rank of American savans. For many years he had been at the head of the United States Coast Survey, and in that position had acquired a lasting fame, not only by his own researches, but by associating with him men of the first order of talent, to each of whom he always gave full credit for any service worthy of special commendation in his annual reports to Congress. In this respect he differed from many leaders in science, who, to say the least, have been slow in recognizing and acknowledging merits in those who aided in such investigations as have resulted in adding lustre to reputations already brilliant. Bache was good as he was generous, and on this account was beloved by all those who had been brought within the sphere of personal intercourse. A few brief statements regarding his career will here suffice. He was the great grandson of the renowned Benjamin Franklin, his grandmother being Sarah, the only daughter of Franklin. He was born in Philadelphia July 19, 1806, and completed his education at West Point, where he graduated in the first rank, having passed four years in that institution, well and favorably known for the rigor of its discipline, without receiving a single mark of demerit. In 1827 he was appointed to a professorship in the University of Pennsylvania, and subsequently was selected as President of Girard College; but the prospect of that institution opening its doors to students for some time being doubtful, he resigned this post and accepted a position as principal of a high school in Philadelphia. From there he was called in 1843 to fill the place made vacant by the death of Hassler, as the head of the U. S. Coast Survey, which position he occupied at the time of his death, although for more than a year disease had prevented him from engaging in his official duties.

Mr. Bache was a corresponding member of the American Institute, and in November, 1856, delivered before that body, at the close of its twenty-sixth annual fair, an oration which occupies forty pages of the Transactions of that year, and which may be called the first great plea in favor of a university of science and art, in contradistinction to those which are now principally devoted to the dead languages. In this address Bache boldly advocated a radical change in our system of education, and showed what institutions were most needed for the better development of our material resources.

To illustrate the manner in which Bache advocated the claims of American discoverers and inventors, the speaker read several quotations from the address alluded to, and concluded with the hope that America would preserve on the roll of fame the name of the distingushed citizen whose loss we now deplore.

The chairman then presented the following paper:

Dr. T. Sterry Hunt, F. R. S., for the past fifteen years associated with Sir William Logan in the geological survey of the Canadas, has lately delivered twelve lectures before the Lowell Institute of Boston, on chemical and dynamical geology, which have attracted great attention. Dr. Hunt, although a native of Connecticut, a graduate of Yale College, and a regular contributor to *Silliman's Journal*, has spent so much time abroad that his American origin has been lost sight of. He has devoted most of his labors to chemical geology, and is now regarded as high authority on all questions connected with that subject. The following seventeen notes have passed under his inspection, and may, therefore, be accepted as a condensed statement of some of the more prominent and novel points presented in his last course of lectures:

The Nebular Hypothesis.

The revelations of the spectroscope demonstrate that the same chemical elements are common to the earth, the sun, and the fartherest stars; and that matter exists throughout space as luminous gas (nebulæ), and condensed into luminous suns and non-luminous planets, three conditions, through which, according to the nebular hypothesis, all matter must pass in the process of condensation. There are potent arguments in favor of this hypothesis, which is supported by so many astronomical reasons, and which supposes that not only the bodies of the solar system, but all those which astronomy makes known to us, had a common origin from a vaporous mass which once filled immensity.

Nature of the Sun.

The sun is the intensified center of our solar system, and may be regarded as a great mass of gaseous matter, so condensed beneath its enormous atmosphere as to have a specific gravity nearly equal to that of water. This condition is not incompatible with a very elevated temperature, for Cagniard de la Tour's experiments afford reason for supposing that at a sufficiently high temperature and pressure all matter may assume a gaseous form without any great increase of volume. The temperature required

to produce this condition for the chemical elements of the sun would produce dissociation or isolation of these elements, such as happens with water, which at a high temperature is decomposed and separated into a mixture of chemically indifferent oxygen and hydrogen gases, which combine by cooling, and form water. In like manner, the cooling by radiation from the sun would produce combination at its surface, giving rise to an intensely luminous mist of oxydized compounds, which would radiate light through an atmosphere holding them in suspension, and so intensely hot as to still contain, in an incombined gaseous form, many of the chemical elements. In this way is explained the non-polarized condition of the solar light and its peculiar spectral phenomena. The mist of the oxydized particles, falling toward the center of the sun, again meets a heat of dissociation, so that the process of surface combination is incessantly renewed. The heat of the sun is maintained by the slow shrinking or condensation of its mass; a diminution of which, equal to one-thousandth of its present diameter, as calculated by Hemholtz, being sufficient to maintain its present supply of heat for 21,000 years. This is essentially Faye's theory of the sun.

The Cooling Globe.

The earth once passed through the same phase which our sun now presents, and finally became a liquid molten mass in which different compounds may have arranged themselves according to their various densities. From what we know of the laws of congelation in such bodies as form the earth, we conclude that the solidification of this mass would take place from the center, since rocks, unlike water, are denser in a solid than in a liquid state. Pressure also, according to Hopkins, would favor the solidification of such bodies as compose the globe, and there would, at last, result a solid globe with a scorified surface, probably irregular from various causes, and perhaps not unlike the present surface of our satellite. This crust would contain all the earthy, alkaline, silicious, and metallic elements, while, in the atmosphere above the chlorine, carbon, sulphur, hydrogen, and nitrogen, with any excess of oxygen, would constitute an atmosphere of enormous density. From this, on cooling, there would be precipitated, at a temperature still very elevated, an acid rain decomposing the silicious surface, setting free its silica in the form of quartz, and forming solutions of chloride of calcium, magnesium and sodium,

which constituted the primeval ocean. From this, the remaining atmosphere, and a superficial portion of the solid crust, all the present order of terrestrial things have been evolved.

The Central Heat.

The conclusions as to the solidity of the earth's center, deduced from chemical and physical considerations, are further supported by the astronomical calculations of William Hopkins on the phenomena of precession and nutation, those of Thompson on the tides, and those of Pratt on the pressure of mountain masses on the earth's surface, all of which conduce to the conclusion that the earth, if not solid to the center, must have a solid crust 2,000 miles or more in thickness. The heat of the mass beneath the cooled surface is still nearly that as which the matter congealed; the loss, of heat by radiation now proceeds very slowly.

Action of Internal Heat.

This heat slowly conducted upward, alters, crystallizes, and metamorphises the sedimentary rocks, and with the aid of water everywhere diffused, gives rise to a soft and pasty layer upon which the solid upper strata repose. From this softened layer have come the eruptive and scotic rocks, which are portions of these, unlike sedimentary beds displaced and forced upward through fissures. Many of these beds are such mixed composition as to yield, by their fusion, great volumes of various gases which finding vent, together with the fused rocks or lavas, give rise to volcanic phenomena.

Volcanos.

Volanic eruptions thus have their seat, not in the original nucleus, which is solid, but in the deeply-buried strata heated by this nucleus, and are no more than pustules or cutaneous eruptions of the earth's surface.

Active volcanos are only met with in or near regions where the accumulations of sedimentary rocks has been great in comparatively recent geological periods; that is to say, where there are great thicknesses of newer secondary or tertiary rocks. Hence their absence from Eastern America; and their occurrence along its western coast. As by the chemical action of heat the deeply buried strata are exhausted, volcanos become extinct.

Atmospheric Action.

The carbonic acid of the air slowly attacks the rocks above the ocean level, and thus turns them to clay, forming carbonates with the soda, potash, lime, and magnesia set free, and carries these down, as carbonates to the sea where the carbonate of soda decomposes the chlorid of calcium of its waters and forms common salt and carbonate of lime. This series of actions is the source of the salt of the sea, of all clays, and of limestones, which are chemical and not organic in their origin. Organic living things do not generate the carbonate of lime, but appropriate it, when found for them by chemical reactions; and thus great portions of our limestone rocks are made up of fossil remains. In forty-four feet of limestone there is separated and condensed from the air a whole atmosphere of carbonic acid gas; the early atmosphere was therefore very dense and unfit for the sustenance of the higher forms of life, until by far the greater portion of this gas had been removed by the formation of the carbonate of lime and vegetable matter now constituting coal and petroleum.

The Climate of Early Times.

The dense atmosphere of early geologic periods was for the earth like a covering of glass, making for the lower levels a condition of things like an orchard-house in which tropical vegetation flourished, even in comparatively northern regions, as we see clearly evidenced by the distribution of organic remains in the various geological formations. Carbonic acid gas mixed with our atmosphere would prevent, to a great extent, the loss of heat by radiation, while offering but little obstruction to the passage of the sun's heat.

Granite and other Crystlline Rocks.

All known rocks are of sedimentary origin, that is, they were deposited from water, and were the result of chemical and mechanical action, consisting chiefly of limestones, clays and sands, or variable mixtures of these. The influence of internal heat, aided by water, upon these where deeply buried, condensed them and rearranged their particles, changing them into crystalline rocks, from which the traces of sedimentary origin are nearly effaced. When again uncovered, these rocks appear as gneiss, mica, slate, or granite. The granitic base or substratum of geology is a fiction. No one has ever seen the primeval crust, which is everywhere

deeply buried beneath its own ruins; and it can be demonstrated that this crust must have been totally unlike granite, which in all cases had a sedimentary and aqueous origin, although, like other softened rocks, it often assumes an eruptive or scotic form. It can be proved that the crystalline rocks of New England were at one time buried beneath sedimentary strata at least two or three miles in thickness, which were, long ages ago, removed by denudation to build up rock formations in other regions.

Geology of the Metals.

The metals were doubtless dissolved in the waters of the primeval sea at its formation, and in great part precipitated in its early sediments to be again dissolved by infiltrating waters and brought to the earth's surface. From their soluble oxydized condition they have been reduced by organic matters, sometimes to the metallic state, as in the case of the copper of Lake Superior, but more generally to the condition of sulphurets. Whenever decaying organic matters encounter sulphates which abound in sea water, they give rise to sulphides or sulphureted hydrogen, which is nature's great agent for precipitating metals and removing them from the terrestrial circulation. Hence we find, in various rocks, sulphurets of iron, copper, zinc and other metals, sometimes in considerable proportion, forming workable beds of ores, but more generally sparingly disseminated. Nature's way of concentrating these sparsely scattered metallic matters is to dissolve them out by certain mineral waters, generally when the waters are deeply buried; these waters ascending through joints or fissures in the rocks, and gradually becoming cooled or changed, deposit upon the walls of these then dissolved matters in the shape of ores, often mixed with spars and other minerals which constitute the veinstones. Experiments show that alkaline bi-carbonates and sulphids which abound in the hot mineral waters are the proper solvents for the diffused metals, and this process of concentrating the metals in veins is doubtless now going on in portions of the earth's crust.

Natural Waters.

Mineral waters are in part derived from decomposing rocks, but in part also from the water which impregnates the buried marine sediments, and is really fossil sea-water. This, more or less modified or diluted by admixture, forms most saline mineral waters. The amount of water imprisoned in the unaltered sedimentary

rocks of the earth is very great, amounting for many limestones and sandstones to from five to thirty per cent of their volume. So that, without speaking of that in the pores of the unknown rocks beneath the sea, it may be said that those of our present continents include in their pores a volume of water which is a large proportion of the bulk of our present ocean. We may even calculate that a time will come, when from the cooling of our globe, and the resulting porosity of the mass, the whole of the water, not already included in the sedimentary deposits, will be absorbed, to be followed by the atmosphere itself; so that our planet will one day be like its satellite, without either sea or air.

Ocean Currents.

The different heating power of the sun in the intra-tropical and polar regions, combined with the rotation of the earth, gives rise to great oceanic currents. Beside the east-west equatorial currents, we have chiefly to notice in the northern hemisphere the warm north-east currents, like the gulf stream, and the cold south-west currents. In the southern hemisphere these are so far reversed that the course of the warm currents is south-east, and that of the cold northwest. Thus to the north of the E. W. equatorial current we have currents running N. E. and S. W.; and to the south, currents running N. W. and S. E., subject, however, to great local deflections from continents, etc. These various ocean currents are the great distributors of the products of erosion, whether igneous or glacial, submarine or subaerial, and have determined the lines of sedimentation, and hence of mountain chains.

Origin of Mountains.

A given geological period will be found in one part of the sea represented by 500 feet, and in another by 10,000 feet of sediments; in the former by soft clays or limestones, and in the latter chiefly by coarse sand and gravel, a subsidence of the yielding crust of the earth in the latter region having permitted the accumulation of this great mass of material. A subsequent elevation of the whole area to the level which prevailed at the beginning of the period would then—but for disturbing causes—present a mountain ridge 10,000 feet high. In such cases, however, the strata in the thickest portion of the formation are generally more or less contorted and depressed. The cause of this is to be found in the fact that along the four or five narrow lines of great north-

east and southwest accumulations, to be found in the northern hemisphere, the whole of the wrinkling consequent on the internal contraction of the earth (from various causes) is concentrated, and this is precisely because the great accumulation of sediments along these lines has softened the rigid upper crust, and thus rendered the folding more easy there than elsewhere. The cause of elevation is to be sought, partly in such foldings, but chiefly in a subversion of the balance of pressure on the somewhat yielding crust of the earth, consequent upon the transference of sedimentay material from one area to another.

Mountains are not due to local uplifts, but to original deposition and subsequent continental elevation, modified by erosion, and in most cases (but not necessarily) by the results of undulation. Erosion operates by preference along the anticlinals, which are lines of weakness, and hence the oldest rocks appear in the valleys, while the newest are on the mountain tops. Mountains are but fragments of wasted continents, which have been spared in the general erosion.

Age of Mountains.

The newest mountains, other things being equal, are the most lofty. The Highlands of the Hudson, the Adirondacks, and the Laurentides, which belong to the great Laurentian system of rocks, are the oldest hills known on the globe, and had essentially their present form before the materials of the Green Mountains, which are of a lower silurian age, were spread over the sea bottom. The White Mountains are still newer, being of the same age as the Catskills of New York, and consisting of the same Devonian rocks, which in New Hampshire are crystalline from metamorphism.

The Catskill and the White Mountains are the remaining separated portions of an immense Devonian plateau, which was once spread across New England, from Pennsylvania to the St. Lawrence. But even these mountains are old when compared with the great mountain chains of our western coast and of Central Europe and Asia, which, geologically speaking, are but of yesterday. The summit of the Alps are of tertiary sediments, which were being deposited beneath the sea ages after this ancient continent had its present form and relief.

History of the Theory of Mountains.

The old European notion of locally uplifted mountains, with granite centres, still finds its place in text-books, but will soon be

forgotten. To American science is due the discovery of the true laws of mountain structure. The Messrs. Rogers and their assistants in Pennsylvania first showed, by careful topographical studies, the laws which govern the structure of the Appalachians; and Prof. James Hall subsequently explained the origin of these mountains by showing their relation to sedimentary accumulation, and to oceanic currents. These views are now being adopted by European geologists, who have learned from our investigations of the Appalachians to understand their own mountain systems.

Law of Geological Progress.

The great forces which build up the world are slow and uniform in their action. Continents have sunken and risen, as they now sink and rise, so slowly that a single lifetime is too short to detect the changes. Nature's economy has been uniform, and the convulsions, deluges and cataclysms by which some would explain geological phenomena, have had no existence, or are but local accidents of no general significance.

Imperfection of the Geological Record.

Each new discovery shows us the imperfection of the geological record, by supplying some page whose absence had before been unsuspected. Thus, in the New York series, we have learned that between the adjacent and comfortable calciferous sandrock and the Chazy limestone, there intervened a lapse of time represented in the adjacent ocean by many thousand feet of fossiliferous strata, which afford a transition between these two contiguous but widely dissimilar formations. In like manner we have evidence that between the Laurentian gneiss of the Adirondacks and the Potts-dam sandstone which covers their base, immense formations intervened, some local in their disposition, and others more widely spread, of which only vestiges here and there remain. While the history of nations is written, for the most part in imperishable records, that of by-gone geologic periods was recorded in the rock formations, which have, by slow destroying agencies, been broken up and served to form new formations, written over with new characters.

Flexible Copper Tube.

Mr. S. H. Maynard exhibited a specimen of flexible copper tube made at the Columbian metal works. A cast ingot is so pressed by rollers that it loses its crystalline form, assuming a laminated appearance, and thus becomes very flexible.

White Lead.

Dr. Fitch explained a new process for the manufacture of white lead in a very short time, by dissolving litharge in nitric acid, precipitating it in sulphuric acid and boiling it in oxalic acid. He also exhibited specimens of the product.

Dr. Vanderweyde said this article should be called the sulphate of lead. It was by Overman's patent.

Dr. Feuchtwanger thought that white lead of a superior kind could not be produced in the time mentioned—an hour and a half.

Fire Detector.

Mr. Dion exhibited a machine by which he claims that fires can immediately be detected and made known. The principle of this detector is that metals expand by heat; the expansion of a wire sets free a catch which acts on a spring bell, giving the necessary information of the presence of fire. This machine can be made sensitive enough to detect an increase of temperature as low as one-sixteenth part of a degree.

Mr. H. F. Walling read the following paper, which he illustrated with a number of beautiful models, also by diagrams, which will be found on another page.

Molecular Motions and their Relations to Universal Force.

The definitions generally given of matter, force, and motion, seem vague and contradictory, owing apparently to the absence in the minds of their authors of a distinct line of demarkation between the conceptions of force and those of matter. For example, most of the so called primary properties of matter, such as impenetrability, hardness, elasticity, etc., are in reality but manifestations of the associated force.

The wonderful discoveries, moreover, relative to the molecular forces, which have been made during the last twenty or thirty years, and the generalizations already derived from them, seem to point towards the more comprehensive generalization, based upon more exact definitions, which is attempted in the hypothesis which forms the subject of this paper.

By this hypothesis, all known forces are considered to be limited portions of an infinite *universal force*, of which the sum of all that is termed "actual" or "kinetic energy," or in other words, that which is actually associated with matter, and causes its motion, is only an infinitessimal portion, comparatively, while the infinitely

vast amount of unassociated force, exists in a condition independent of, or unrecognized by, the human senses. Guided by inductive reasoning, based upon observed facts, however we may consider every position in space to be occupied by a force in every direction. each force in any one direction being infinite in amount.

Without entering upon a useless speculation as to the ultimate nature of force, it may be simply defined as that which, when associated with matter, causes it to move, and we shall find that the amount so associated with any given matter, is subject to change, under the influence of other matter, in such a manner as to present the *appearance* of a transferrence of force from one body to another. We shall probably find, however. on investigation, that this appearance is not sustained by the reality.

Gravitation, the primary form of association between force and matter, is made up of two resultant forces, always equal and opposite, and is due to the interception by each pair of gravitating atoms, of portions of two opposite rays of force, by which means the internal forces, or those between the atoms, are rendered less than the external forces. The ratio of the intensity of these resultant forces to the inverse squares of the distances, is an obvious consequence of the radiant nature of the forces.

The "Third Law" of Newton, that *action and reaction are equal and opposite*, is simply a corollary of that of gravitation just stated, namely, that the interception of universal force by each pair of atoms is equal and opposite. This will appear more fully as we proceed.

The *inertia* of an atom is measured by the amount of a given force with which it becomes associated in a given time. Matter being considered as a vehicle for force, inertia is its carrying capacity. The amount of interception, and consequent intensity of the gravitation, between two atoms, depends upon the amount of inertia they possess, or if estimated between two masses or aggregations of atoms, upon the united sums of the inertias, due allowance being made for variations in direction and distance, of the component atoms.

The primary properties of matter are indentity, position and inertia. All other general properties such as extension, hardness or rigidity, impenetrability, elasticity, expansibility and compressibility, and the special properties of different substances are the manifestations of associated force.

The "*molecular forces*" including heat, light, electricity, mag-

netism, chemical attraction, cohesion, or polar crystalline force, adhesion, elasticity, etc., are identical in their nature and origin with the force exhibited in the motions of masses of matter, being the manifestations of universal force acting separately upon atoms or molecules, instead of collectively upon their aggregations.

Attractions and *repulsions* have no real existence as inherent properties of matter. Atoms or masses of matter have no power to act upon each other across vacant spaces. Their apparent attractions and repulsions are the dynamical effects of primarily external force, which has become associated by mutual interceptions producing resultant gravitations. The terms attraction and repulsion are, therefore, to be understood to signify effects and not causes.

Heat, the principal repulsive force of nature, is the momentum or centrifugal force of atoms in their paths or orbits about each other. The measure of its quantity in a given body, as a positive force is the aggregate momentum of the atoms of that body, modified by their angular velocity.

The *temperature* of a body is the mean or average momentum of its atoms, and it has a uniform temperature when the mean momentum of all the atoms is equal. If, however, in practical problems the sensible energy or power of performing *work* is to be considered, its proper measure will be, as in the case of masses, the total *vis viva* or living force, similarly modified.

Since, from its essential nature, force can never be directly recognized by the senses, we perceive its existence only by its effects when associated with matter. Of these, gravitation points more directly and obviously than any other to the *independent* existence of its cause. Most other phenomena *seem* capable of explanation by supposing a transferrence of the force, which is already associated with one body, to another, by *contact*.

Contact, indeed, is the *only* way, apparent to the senses, by which such a transfer of force takes place. If, therefore, our conceptions are to be limited by one direct sensation, a *plenum* would seem indispensable for explaining the transmission of forces across the celestial and inter-atomic spaces. A careful investigation of this subject, however, with a strict adherence to the simple definitions of force and matter, already given, will probably lead most minds to the conclusion that no transfer of force ever takes place by the actual contact of bodies, or their component atoms; and indeed, that no actual transfer takes place at all, the *apparent* trans-

fer being due to a continually equal and opposite, though varying disturbance of the rays of universal force, producing the effect called *action and reaction.*

A comet will approach the sun from infinite space, pass around it, and then recede from it in the opposite direction, without any transfer of force taking place. Nor is there any logical or mechanical absurdity, if we accept the definition already given, in conceiving that two atoms may gravitate directly to each other, and even pass through the same portions, or through each other, without the occurrence of a transfer of force.

It is true that this could not take place if the atoms were as described by Newton, "solid, massy, impenetrable, movable particles, so hard as never to wear or break;" but this view is not only discordant with inductive reasoning, based upon modern discoveries in physical science, but leads to logical absurdities, and apparently meets with little favor among the more eminent modern physicists.

Impenetrability will, therefore, be considered not as a property of *individual* atoms, but as a manifestation of the force associated with *aggregated* atoms, by which the approach of one aggregation or body to another, involving the intermingling of their respective atoms, or their occupancy of a smaller space, is powerfully resisted, and beyond certain limits rendered practically impossible.

Chemistry and optics teach us that the atoms of any homogenous substance are uniform in the amount of their inertia throughout the visible universe. By the laws of mechanics, two isolated atoms, acted upon by gravitation, will move about each other in one of the forms of conic sections.

If the atoms are entirely free from lateral motion they will move in a *right line*, passing through both, in which case the secant plane becomes tangent to the cone.

The nature of the motion in this path will depend upon the amount of associated force. If this be *less* than the maximum of gravitating force which they are able to accumulate in each other, in other words, less than that they would acquire by falling together from infinite space, then a constant vibration will result, the atoms approaching with accelerated velocity, passing through each other, and then receding with retarded velocity to a distance which is a measure of the living force of the atoms.

If the force at contact is exactly *equal* to this maximum or *potential of gravity*, if we may so call it, the atoms will, after con-

tact, separate to an infinite distance, constantly approaching, but never reaching, the zero limit of velocity.

If the associated force in the approaching atoms is *greater* than that of the potential of gravity, the atoms, after contact, will also recede never to return, and the limit of ultimate velocity will be the excess of the former force over the latter.

Upon these relations between the associated and potential forces, depends the so-called attraction or repulsion between the atoms; nor is it necessary to make the comparison between them at the instant of collision, for the difference between the entire associated force and that portion due to gravity will evidently be constant.

When in the case of the two isolated atoms a lateral force is introduced, we shall have analogous results, arising from similar relations between the amounts of associated force and the potential of gravity, if the comparison is made between the latter and that component of the former, which represents the tendency of the atoms to approach or recede from each other, *i. e.*, the centripetal or centrifugal force. Corresponding to the described cases of rectilinear motion are three classes of orbits, all curves of the second order or conic sections.

First, the *ellipse*, including the circle, which is an ellipse having equal axis, Fig. 1 and Fig. 2. These correspond to the *vibrating* atoms, and will occur when the centrifugal force is *less* than the potential of gravity.

Second, the *parabola*, Fig. 3, which is an ellipse with an infinite transverse axis. Here the centrifugal or centripetal force is just *equal* to the potential of gravity.

Third, the *hyperbola*, Fig. 4, in which the associated force is *in excess*, and the atoms merely deflect each other from their courses.

In all these figures, A and B represent the atoms, and C the centre or common focus about which they move. A, B and C lie always in a straight line, forming a double radius vector, each part of which describes equal areas in equal times.

If the two atoms are unequal in inertia, the centre of motion or focus of the orbit will be in the centre of gravity, and the paths described will be similar, but inversely proportional in dimensions to the inertias of the two atoms.

The three possible relations of the atoms to each other, then, are first, *attraction*, second, *equilibrium*, and third, *repulsion*, each of which may be changed into the others by adding or abstracting momentum or centrifugal force, ordinarily called heat. The first

Figures Illustrating H. F. Walling's Paper on Molecular Motions.

Fig 1

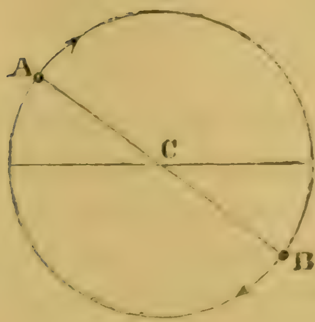


Fig 2

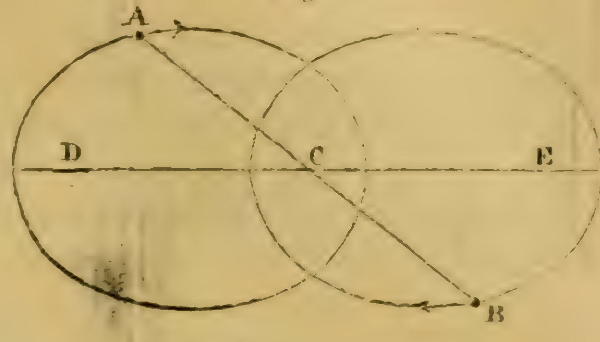


Fig 3

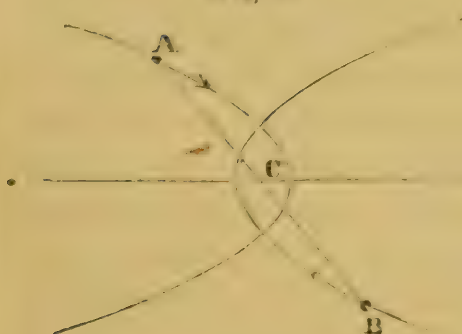


Fig 4

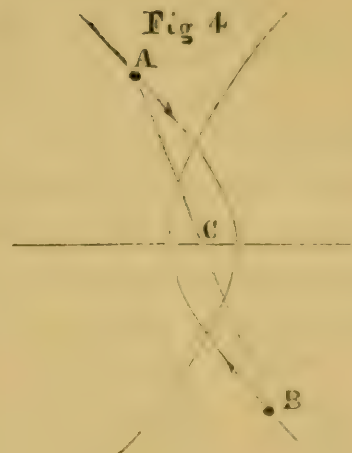
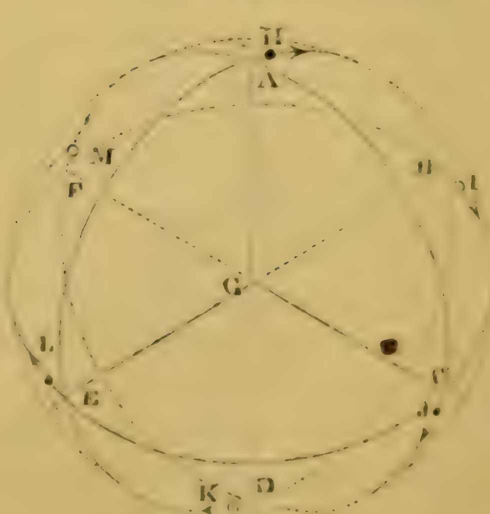


Fig 5

Fig 6



of these relations, that of attraction, obtains in the *solid* condition of matter; in the *liquid* state, the atoms approximate to the second relation or that of equilibrium; and in the *fluid* or *gaseous* state to the third or that of repulsion.

In the gaseous condition the atoms move with great velocity in straight lines, or very flat hyperbolas, and the virtual or resultant repulsion causes them constantly to tend to diffuse themselves through a greater space, which tendency is only limited by the exercise of a powerful external gravitation towards some heavy object like the earth, or the coercive power of containing surfaces of solid or liquid bodies.

The supposed *etherial medium* of the celestial spaces, if it exists, may be composed of atoms whose almost infinitessimal amount of inertia, when compared with atoms of grosser matter, is compensated to some extent by their enormous velocity of motion.

The equilibrium of the liquid state would, according to this view, be an unstable one, and there should, apparently, be no interval between the temperatures of congelation or liquefaction and that of ebullition. There are, however, important modifying circumstances, to be hereafter considered, connected with these transformations, among which are the restraining influence of external "pressure" and the evolution and absorption of "latent heat," which occasion an interval of variable width, in different substances, between the temperatures at which the two transformations occur.

Yet, in every part of this interval, liquids have a tendency to assume the gaseous form or to *evaporate*, this tendency depending in part on the amount of similar vapor already contained in the surrounding space or medium, and in part on the external pressure and temperature. So that if to the surface of a liquid, a vacuum or unsaturated medium is continually presented, the liquid will gradually and entirely evaporate at any temperature above its congealing point. Although this evaporation goes on with extreme slowness among certain substances like fixed oils, etc., the unstable nature of the liquid condition is more or less evident in all known liquids.

In the investigation of the changes which take place in the atomic orbits during these transformations we have to consider the motions, not alone of single pairs but of vast numbers of aggregated atoms, a fact which adds immensely to the complication and

difficulty of the problem if subjected to a rigid mathematical investigation.

We may however consider the application of the general principles already arrived at to these aggregations, and, guided by the results of actual experience, and a perception of the harmony, symmetry and uniformity which pervades the universe, we shall perhaps find some of these difficulties less formidable than they at first appear, and be led to conclusions which will enable us to unlock some of the great secrets of nature.

Let us then suppose that the excess of atomic motion or heat over potential gravity, produces, in the gaseous condition, a virtual repulsion of the atoms, alternating with and preponderating over a powerful attraction. This attraction, moreover, reinforces the momentum which is converted, after collision or *pericentre* passage, (by which is meant the nearest approach to the centre of gravity,) into repulsion.

The paths by which the most direct approaches, and yet the widest separations could be made, in an aggregation of uniform atoms, would seem to be rectilinear ones, crossing each other at right angles, in three directions, and dividing the space occupied into small imaginary cubes. Along the edges of these cubes we may suppose six atoms to simultaneously collide, or pass their pericentre, at the cubical angles, and then to continue in their courses, diverging from each other, their places being successively supplied by atoms from the adjacent cubical angles or molecular centres. A single pair of atoms will collide or pass their pericentre on their passage from angle to angle at the middle of every cubical edge.

Matter thus constituted will constantly tend to expand, but when confined between solid or liquid surfaces, these surfaces will sustain a "pressure," equivalent to the surplus of momentum over potential gravity, in the entire aggregate of atoms.

This pressure is not produced by an actual contact, but by the passage of the atoms of the gas around those of the solid or liquid under the laws of gravitation and momentum, in a manner similar to that in which a comet passes around the sun. The exact equality of the opposite gravitational disturbance or of action and reaction, causes the sun to be impelled in one direction with precisely the same force that the comet is thrown in the other, the difference between the velocities of the two bodies being in inverse ratio to their masses or aggregate inertias.

It will be seen, that supposing the atoms to move in rectilinear

paths, the law of Mariotte, viz.: that at equal temperatures the volume occupied by the same quantity of gas is in inverse proportion to the pressure it exerts or sustains, is a direct consequence or corrollary of the hypothesis here advanced. We have only to substitute *equal momenta* for *equal temperatures*, and it evidently follows that the aggregate pressure must, in a given volume, be proportional to the number of atoms, or conversely, the volume occupied by a given number of atoms must be inversely proportional to the pressure.

The development and absorption of heat by the compression and expansion of gases is another evident consequence of this hypothesis. By compression the atoms are brought under a more powerful gravitating influence, which increases the momentum, or in other words, the temperature of the gas. In expansion exactly the reverse of this takes place, the atoms being withdrawn to a greater mean distance from each other, they are less reinforced by gravity, and their momenta or temperatures are reduced.

The latent heat which is developed in the change from the gaseous to the liquid state, and absorbed in the reverse process, is due to a similar cause, as will be more fully seen when we investigate these transformations.

The remarkable law discovered by Dulong and Petit, that the specific heat of elementary bodies is inversely as their atomic weights, may be considered as direct evidence in support of the hypothesis that heat is momentum. For if we admit this hypothesis, remembering that the measure of specific heat is not one of absolute force or momentum, but of *vis viva* or *work done* in the separation of atoms, or the elevation of their temperature, it obviously follows that more of it will be required to produce the same momentum in a light atom than in a heavy one, in the exact ratio of the increase of velocity imparted. This is just what Dulong and Petit have, by careful experiment, established in regard to many substances, both simple and compound.

To understand this clearly, we must remember that momentum or quantity of motion, which is here made synonymous with temperature, when referred to atoms, is measured by taking the product of the weight into the velocity, while vis viva, or work, is proportioned to the *space effect* produced, or to be produced, as in raising weights, and is as the weight into the *square* of the velocity. So that if we divide the vis viva of a light body or atom by

that of a heavier one possessing the same momentum, we shall obtain as a product a number which expresses the ratio of increased weight in the heavier body.*

Several other important coincidences between well established experimental facts and the conclusions to be drawn from the hypothesis that temperature is identical with momentum, might be adduced, and will readily occur to those familiar with the subject, but their farther consideration will be left for a future paper.

In tracing the transformation from the state of vapor or gas to the liquid condition, we have to suppose that the momentum of atoms falls below the potential of gravity, so that instead of moving in continuous directions, the six or more atoms forming a molecule, will vibrate across, or more probably, revolve about centres, in elliptical orbits. These orbits will be *interlinked* at their vertices around their foci. The atoms composing a single molecule, instead of being continually and mutually interchanged with those of other molecules, as in the case of gas, will remain permanently associated.

At the instant when this occurs some remarkable changes take place. The atoms drop down upon each other from the distances due to their previous direct motions, and the virtual repulsion of their surplus momentum, to that which will give equilibrium in the new closed orbits, a distance which we find, practically, to be very considerable.

A reënforcement of gravity is produced by this approach of the atoms, assisted, perhaps, by the interlinking of the orbits, and this reënforcement is accompanied by an acceleration of motion and consequent increase of temperature, or development of "latent heat."

The great difficulty experienced in reducing the bulk of a liquid, even when we subject it to a very powerful pressure, is an indication of the immense amount of force associated with the matter contained in a small bulk, and is, doubtless, partly due to the closed form of the orbits, as well as to the augmentation of gravity and consequent momentum occasioned by the proximity of the atoms.

As already intimated, *pressure* is not to be considered as the effect of contact, as commonly understood in the case of what is called statical equilibrium. Under the present hypothesis a stati-

* The relation of vis viva or work to momentum, has been made the subject of another paper read by me before this Association, on the "Measure of Force in Moving Bodies." (See p. .)

cal equilibrium is an impossibility, but, in all aggregations of atoms and molecules, dynamical equilibriums exist, where the accelerations of atomic motion, caused by the augmentations of gravity due to nearer proximity, produce what is known as pressure, namely, a contraction of the orbits, accompanied at the instant of its production by an elevation of temperature. On again separating the atoms, the pressure undergoes a corresponding diminution, accompanied by a depression of temperature.

In both the gaseous and liquid conditions we find a perfect or nearly perfect freedom of motion of the molecules among each other, so that they yield, so far as change of form is concerned, to the slightest external force, and we see nothing in the forms of the orbits or in their connections, one with the other, to prevent this, but we come now to the third or *solid* condition of matter, in which *rigidity of form* is the important characteristic.

If we investigate the effect of a still further diminution in the heat or velocity of atoms, we shall probably find that the long elliptical, or nearly parabolic orbits, become gradually somewhat reduced in size and changed in form, so that at a certain period a second or lateral interlinking, at the extremities of the conjugate axes or diameters takes place, and a form of molecule is originated which gives this rigidity of form to solid bodies.

Doubtless the most direct path to positive knowledge in regard to the forms of solid molecules, is through the study of crystalline forms and forces. It is now generally understood that cohesive attraction, in homogeneous substances, is identical with the polar force of crystallization. A glance at the general features of crystallogeny, as now taught, will be likely, therefore, to render essential aid in the present investigation.

Prof. J. D. Dana, probably the highest authority on the subject, reduces all the various forms of crystals to primary ellipsoids, which he supposes to be held together by a powerful attractive force which suddenly comes into existence at the instant when crystalization takes place, at the extremities or poles of conjugate axes of the ellipsoids.

While this hypothesis is amply sufficient to account for all the various *forms* of crystals, which it does in a most simple and beautiful manner, the *source* of the polar force, by which the previously liquid molecules are compacted into the hard unyielding crystal, is left as much in the dark as before. What is the nature and constitution of this ellipsoid? Is it solid, hard, elastic, etc.?

Why does the polar force remain dormant in the liquid, and suddenly start into existence at the instant of solidification? Why is it confined to six mere points on the surface of the ellipsoid? To these inquiries, the most diligent questioners of nature seem as yet to have received no satisfactory answer.

What will now be offered, is barely more than a suggestion, which is thrown out with the hope that the new field of inquiry thus indicated, will, in skillful hands, prove prolific of fruitful results.

Upon the surface of the primary ellipsoid of Wollaston and Dana suppose three ellipses to be described by the intersection of bisecting planes parallel with the sides of the circumscribing prism and to the planes of crystallization. These three ellipses will intersect each other at the six poles of crystalline attraction. Removing the ellipsoid, we will retain only the imaginary ellipses, to represent the orbits of the three pairs of atoms, which we have already considered as forming the molecule in the liquid and gaseous states, one pair of atoms revolving in each orbit.

To account for the ellipsoidal forms of the molecules, we have only to bear in mind that in a body of uniform temperature the mean momenta of the atoms are equal. If therefore the pairs forming a molecule are unequal in inertia, it follows that the heavier pairs will move in shorter orbits.

The analytical investigation of the motion of six or more atoms, subject to mutual gravitations, seems, at the first glance, to be too complicated a problem for the human intellect. It will be found, however, to possess certain features of symmetry, which will perhaps bring it practically within the grasp of the mathematician. To illustrate this symmetry, we will bestow a passing glance upon the most simple case of the ellipsoidal molecule, viz., that with equal axes, or the true sphere, in which the three orbits are circles, intersecting each other at right angles.

By the diminution of heat or momentum, the long elliptical orbits of the liquid have been rounded into circles which intersect each other at the six poles. A system of this kind is shown in figure 5, which represents the molecule at the instant when each pole is occupied by an atom. A more convenient way, however, to study the relative motions of the atoms, is by constructing a wire model of the intersecting orbits, upon which bits of wax may be placed to represent atoms. The directions of motion may be

indicated by pins stuck through the wax.* The figure is a projection upon a plane which makes an angle of 45° with each of the three rectangular axes. Those portions of the orbits lying above the plane of the paper are represented with unbroken lines and the atoms on them are made black, while below this plane the lines are dotted and the atoms open. The circumscribing dotted circle is the section of the imaginary sphere of the molecule made by the paper. This circle will be called the *dynamical equator*, for reasons which will presently appear. The two *dynamical poles* of this equator are projected at G, and are the points where the dynamical axis, a line passing through the centre of the molecule at right angles to the plane of the dynamical equator, intersects the surface of the molecular sphere. The six atoms A, B, C, D, E, and F, are moving in the directions indicated by the arrows, and each orbital pole is successively occupied, first by the atom of one plane and then by that of the other, of the two whose intersection forms the axis of that pole.

The question now naturally arises, whether the atoms of a system so constituted can continue to move in stable equilibrium. While an analytical discussion of the question may prove excessively intricate and difficult, the following simple geometrical presentation is believed to demonstrate the stability of the molecule.

We will first suppose that at the instant, represented in Fig. 5, the six atoms are in a state of equilibrium, i. e., the centrifugal and centripetal forces of each are balanced. Since in this position the atoms are distributed at equal distances around their common centre of gravity, G, the resultant of gravitating force acting upon each one is in the direction of that centre, and all these resultants and the velocities of the atoms must be exactly equal.

Let us now suppose that each atom has moved an indefinitely small distance in the direction of the arrows to the positions represented in Fig. 6. Since the initial velocities were equal, the small distances traversed will be equal, and they may be taken so small that the paths will not differ materially from arcs of the circular orbits represented.

The resultant forces acting upon each of the atoms, in its new position, is now to be considered. The atom H is acted upon by its companion atom K, in the direction of the centre G, and with

* A model of this kind was exhibited when this paper was read, and the demonstration here given was illustrated by it.

the same attractive force as before, so that no change of effect is produced. The effects of the two other pairs must be considered separately.

The atom H is more distant from J than from M, for its distance from M is less than 90°, since it is the hypothenuse of a right angled spherical triangle, of which the sums of the two legs is 90°, while the distance from H to J is greater than 90°, being the hypothenuse of a right angled spherical triangle, of which one side is 90°+C J, and the other, the distance A H.

The resultant attractive force exerted by J and M upon H, therefore, is not in the direction H G. It is, however, since a straight line drawn from M to J will cut through G, in the plane of a great circle of the sphere, and we may decompose it into two forces, one in the line H G, and the other tangent to the sphere at H, forming nearly a right angle with the direction A H, and tending to cause H to diverge a little from its orbit to the left of its direction of motion.

This component of the forces exerted is the only one that can disturb the stability of the system, for the momentum and central attraction will keep the atoms in their orbits, and by amplifying or reducing the orbits, preserve an equilibrium between the centripetal and centrifugal forces.

In like manner it may be shown that H is more strongly attracted towards I than towards L, and the tangential component of the resultant attractive force will be equal in amount to that of M and J, but its direction will be so nearly that of A H, that the component of divergence may be disregarded as being the indefinitely small portion of an indefinitely small quantity, and the whole tangential component may be considered as expended in accelerating the velocity of H in its orbit.

By similar reasoning we find that while each of the atoms H, J and L above the dynamical equator diverge a little to the left of the circular orbits represented, when viewed from without, I, K and M, below the equator, diverge to the right. Continued action of the same kind will take place upon H in the same direction, but with less and less disturbing power, as the motion of M takes it more and more in the rear of H, and that of I more and more to the right. The effect upon each of the other atoms is obviously similar.

In the meantime all the atoms are approaching the dynamical equator, and must cross it simultaneously, since the acceleration

Fig 7

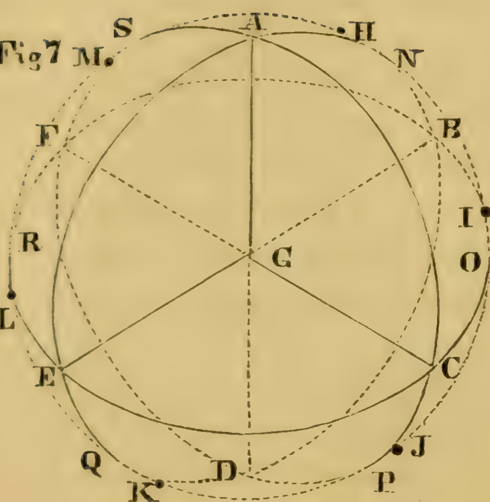


Fig 8

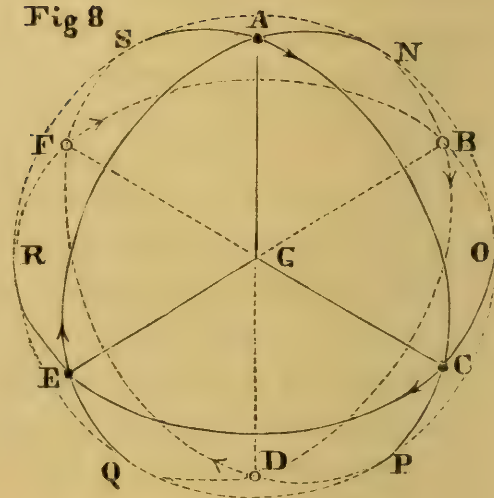


Fig 9

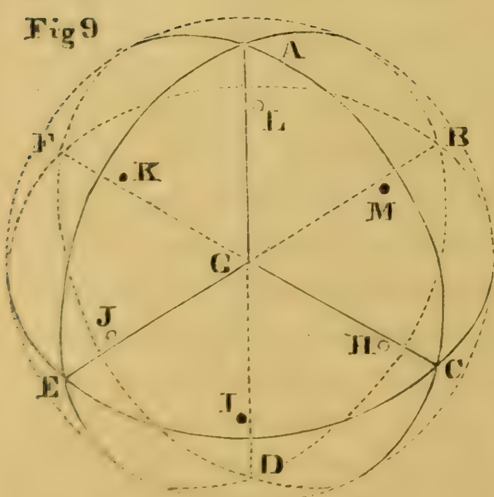
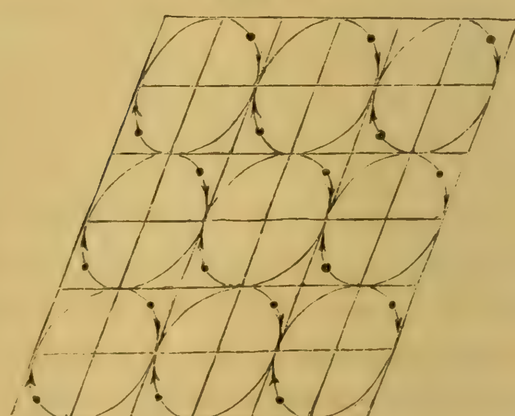


Fig 10



and relative divergence of each towards it is exactly the same. They will, moreover, be equi-distant from each other on reaching it, the distances MS, HN, IO, JP, KQ, and LR, from the atoms to the points where their original planes of motion cut the dynamical equator, being all equal, and in one direction around the equator, as represented in Fig. 7.

The atoms having each crossed the dynamical equator, a reverse action will now take place. The disturbances will go in in exactly the same amounts, but in the opposite orders and directions, so that the atoms will arrive at the six origninal poles of the system, each 90° distant from the point where it is represented in Fig. 5, and the directions of motion will become those represented in Fig. 8.

Pursuing a similar investigation to that already conducted, in regard to the subsequent motions in the system, we shall find that the atoms, in approaching the dynamical poles, will approach each other; but from the position of nearest approach, represented in Fig. 9, a reverse action again takes place as before, and the atoms, after eliminating their divergence from the true circles, again occupy the six original poles, as in Fig. 5, each atom being now 180° from its original position, and in that formerly occupied by its companion atom. A series of precisely similar semi-revolutions will continue to succeed each other until some disturbance from an external force takes place.

The application of a similar demonstration to ellipsoidal molecules with unequal axis will not be attempted in this paper. It will probably be found not very difficult, however, to the expert mathematician, particularly if the principle of a tendency towards equality of atomic momentum, in aggregated numbers of unequal inertia as well as in single couples, be admitted. When the molecules are made up of single or compound atoms and the pairs are of different weights, the heavier ones must, in accordance with this law, move in smaller orbits as we have already observed. The companion atoms of each pair, however, must always be equal, as otherwise they could not move in the same orbit, either circular or elliptical.

The thought will doubtless occur here, that the equal atoms of a single pair can move in the same orbit only when that orbit is circular. When the motion becomes excentric or elliptical, it must then be two orbits about a common focus, which is the centre of gravity of the two atoms. (See Fig. 2.) It does not seem unreasonable, how-

ever, to suppose that in the molecule composed of six atoms, the centre of motion will be the centre of gravity of the system, and that the ellipticity of the orbits will result entirely from the inequality of the different pairs and not from excentricity of motion.

If, therefore, we suppose the molecules of different chemical compounds to be made up of atoms, or clusters of atoms, of different weights, we have an adequate cause for the ellipsoidal forms of such molecules and all the consequent varieties of crystalline form and structure. If this view be correct it may not be impossible for the mathematician to determine the chemical constitution of a crystal by its geometrical properties.

The interlinking of the solid molecules will be seen in Fig. 10, which is a section through a single layer of molecules in the plane of two axial directions. According to the idea of impenetrability here advanced, it seems to be immaterial whether each couple of approaching atoms actually collide at the crystalline poles, or pass around them as foci.

The most formidable argument, perhaps, which may be brought against this view of cohesion or crystalline attraction, is the discrepancy between terrestrial and atomic gravitation, when we consider the enormous disproportion between the masses. A suspended body, for example, is sustained by its own cohesion or atomic gravitation against the gravitating force of so immense a body as the entire earth. A thread or wire, moreover, will sustain many times its own weight, and yet the attraction between two considerable bodies of heavy material, even when delicately suspended at an extremely minute distance from each other, is so small as to be practically insensible.

The explanation of this apparent anomaly may be found in the infinitessimal distances at which the atomic gravitation acts, when compared with the gravitation of masses. The powerful resistance to compression in solids and liquids, affords an indication of the entire force associated with atoms at minute distances, to which the resultant virtual attraction in solids, probably bears no inconsiderable proportion, even at the maximum distance between the adjacent atoms of a crystal, which is that of a quarter of an orbital revolution. This distance may be supposed sufficiently minute to produce, in atoms, at the first order of distances, a very powerful attraction, when multiplied by the number of interlinking molecules in the cross section of a solid body. When once sepa-

rated by forcible rupture, however, this interlinking cannot be restored, owing, probably, to the interposition of gaseous molecules, the inequalities of the surface, and, perhaps, to some modifications of the forms of external orbits, by which the re-adjustment of the corresponding poles, without passing through the preparatory liquid state, is rendered impossible. The distances between the orbits of the two bodies are now immensely increased, so as to become apparent even to the senses, and the law of the inverse squares would seem sufficient to account for the enormous diminution of the attractive force.

Bridge Building.

This selected subject for discussion, was taken up by Mr. Alfred Boller, C. E., who, in a speech of half an hour, rapidly sketched the progress of bridge building in America, confining his remarks principally to the immense structures on our various railways. Some of the advantages and defects of the systems now in use were pointed out. He illustrated, by diagrams on the blackboard, the lines of pressure and resistance, and suggested various improvements. A high compliment was paid to American genius as evinced in the great railroad bridges of this country. It is to be regretted that no report of Mr. Boller's remarks was made at the time.

The association decided to take up the subject of bridge building at a future meeting. Adjourned.

American Institute Polytechnic Association,
February 28th, 1867.

Prof. S. D. Tillman, in the chair; T. D. Stetson, Esq., Sec'y.

The following notes on science and art were presented by the Chairman:

Thread from the Cotton Stalk.

An ingenious person in New Orleans has made from the stalk of the cotton plant a fine strong thread, resembling that made from flax, which he proposes to use in the manufacture of cloth.

Solar Heat.

Prof. Benjamin Pierce, of Harvard College, has shown, without resorting to the meteor theory for sources of replenishment, that

the sun is capable of furnishing heat to our planet for at least 30,000,000 of years.

Picture of a Podura Scale.

A photograph of a Podura scale has recently been made by Mr. Curtis, of Washington, under the direction of Major Woodward, with the aid of a microscope having a power of more than 1,000 diameters. The quill-like markings on the surface were splendidly rendered. This photograph was warmly commended at the last meeting of the American Photographical Society.

A Photographic Wonder.

The photographic process is now brought to such perfection that it can produce a picture of a projectile the instant it leaves the mouth of a gun, and before the recoil has taken place. The most sensitive collodion must be used to effect this, and in order to have the exposure only at the instant required, the charge in the gun is ignited by a galvanic battery. This is done by having a small portion of the conducting wire of platinum which is placed in contact with the powder. When the electric current is sent through the wire the platinum becomes red hot and ignites the powder. This very current is sent through a coil of wire around a core of soft iron, which thus becomes a magnet and lifts the disk in front of the lens. Yet the instant the platinum melts the current ceases, and the iron core being demagnetized can no longer hold up the disk. Thus, in much less time than it could be effected by the human hand, the plate is exposed and covered; besides the exposure takes place at the precise instant required.

Solidified Extract of Oyster.

This is the designation of a new form of food for which patents have lately been granted to a gentleman in this city. The extract is made from the natural liquor or juice of the oyster reduced to a state of dryness by evaporation *in vacuo.* It is designed chiefly for the production of soup, but may be used for enriching other soups, gravies, etc. Being in the form of a coarse powder and packed in tin cans or bottles it remains unchanged so long as kept dry, is easily dissolved and convenient to use. The contents of a can containing twelve ounces will make, without other addition, except salt, pepper, and the requisite proportion of water, 100 dishes of nutritious, well flavored oyster soup, and at a cost of material not exceeding two cents a dish. A man on an overland

trip might carry on his person the material for many hundred dishes of oyster soup without inconvenience. The secret of the cheapness of this preparation is that the inventor economizes what has been regarded as a waste material, for it is well known that the large and fine oysters sent westward in cans must first be separated from their natural juice, which, until now has been thrown away. The low price at which the extract can be sold, and its portability, will make it an article of staple demand, at points distant from the seaboard, among the million who long for sea-flavor.

The Ant.

This industrious insect is remarkable for its muscular strength. It often bears a burden ten or twelve times heavier than its own weight. As ants are dormant at a temperature a little below the freezing-point—about 27° Fah.—their ravages in our climate are not to be dreaded, yet in cities where buildings are kept constantly warm during the cold months they are often very numerous. In New York the progress of a small species of ant, first noticed in the lower part of the city, has been regular toward the north, but hardly keeping pace with the compact extension of buildings. The ant, though a scavenger, is very troublesome in the culinary department. It is carniverous, and does not feed on corn and other cereals as many suppose, but it is very fond of sugar and saccharine juice; for this reason it sometimes attacks ripe fruit. Ants become formidable in warm climates where they are able to continue their operations without interruption from cold throughout the entire year. In tropical regions, particularly in Africa, the habitations erected by ants are superior in structure to the huts of the native. According to M. Malonet, ant structures in the forests of Guiana attain to the height of fifteen and even twenty feet; when viewed from a distance on these widely extended savannas, they resemble the rude huts of the savages, but they contain a race more ferocious than the savage or the tiger himself, and cannot be approached by man without the utmost danger of being devoured. When new settlers, who aro clearing the country, meet with any of these in their progress, they must desist their task and even abandon the neighborhood, unless they can speedily destroy the enemy in the very heart of the citadel which protects him, and from which he is able to pour an overwhelming number of combatants. The only method of accomplishing this is to dig a trench all round the ant-hills, and after having filled them with

dry wood and set fire to it on every side by lighting it quickly in different places so as to cut off all retreat, to batter down the edifice with cannon. The ants thus scattered soon perish in the flames.

The red ant, *Formica rufa*, when irritated ejects an acid liquid. This acid which produces a stinging sensation when applied to the skin, is found in a free state in the stinging-nettle (artica urens). The ant being to chemists the first source of this acid, the compound received the name of formic acid, but is now made artificially from oxalic acid, and in several other ways.

Food for Infants.

Baron Von Liebig was led, from family considerations, to investigate the question of the nutrition of very young children, which involved the analysis of all articles of food for infants. He states that although cow's milk contains the ingredients found in human milk, they are not mixed in the same proportions; besides, the former is of an acid nature, while the latter has an alkaline reaction. The same objection applies to pap, prepared from flour or other starchy substances, which, although finely ground and dissolved by boiling, has not really undergone such chemical change as to bring it into the condition for easy assimilation. Liebig claims to have remedied the defects in the common substitutes for human milk, by making the farinaceous substances perfectly soluble by correcting their acidity, and by uniting the substances until in such proportion as to imitate as near as possible food designed by nature for the infant. The recipe which he has devised for the benefit of the public is as follows:

In a small pan thoroughly mix half an ounce of wheat flour with five ounces of milk. In a second vessel mix half an ounce of malt with two ounces of water and thirty drops of a solution containing eleven per cent. of carbonate of potassa. Let the contents of the small pan be brought slowly to the boiling point, and boil for three or four minutes, then add the contents of the second vessel, put on the lid and let the pan remain in a warm place—not exceeding 148° Fah.—for half an hour, when the pan must be again placed over the fire, until the mixture begins to boil. The contents should then pass through a sieve, which will separate the exhausted bran. The fluid thus produced has the pleasant flavor of fresh bread, and is so sweet as to require no sugar. Children are very fond of it, and require less of it than of pure cow's milk

to satisfy their craving. It is said many children on the verge of death have been saved by the use of this new preparation. Invalids, and especially mothers during the period of nursing, have been greatly benefited by this food. As careless or ignorant servants may not always correctly mix the ingredients mentioned, the article is now carefully manufactured under the name of "lactine;" but almost any American housekeeper can prepare the mixture from the directions above given.

Liebig asserts that one-half the deaths of infants, deprived of their natural food, may be ascribed directly to the use of the customary pap. There are doubtless other mistakes made in the management of children, for of all the deaths in the United States, according to the last census, not less than twenty per cent. were of children under twelve months old.

The Smoke Question.

Dr. R. Angus Smith, F. R. S., states that the amount of unconsumed carbonaceous matter which passes off from the chimneys in the city of Manchester, England, is sixty tons a day. A very small amount affects the atmosphere; a grain in eighteen cubic feet is sufficient to convert good air into Manchester air, as far as the carbon is concerned. About one-half is due to tarry matter, and the other half to carbon only. The black matter is the coloring material of all the smoky towns of England, and to a great extent of the clothes, as well as of the person of the inhabitants. They live in houses colored by it, and walk on roads colored by it, and can see the sun, the moon and the heavens only after having been, to their eyes, colored by this universal tincture. All the coal used in England is soft or bituminous, containing always one per cent. of sulphur, and sometimes much more. This unites with the oxygen of the air, and forms sulphurous acid. It is the sulphur acids which render the air and rain of Manchester so destructive to metals. Iron roofs will not remain there; even houses cease rapidly to exist, and become old at an early period. The lime of the mortar becomes sulphate of lime, and the rain washes it away. The very stones decay under the action of acid, and the bricks crumble more rapidly. Even in places less troubled with smoke the decay is seen. The Parliament houses of London, built to remain for ages, are decaying rapidly, and turning into gypsum and epsom salts. The finest buildings in London appear less handsome than flimsy structures in many continental cities. The pecu-

liarity of the climate of England is a great enemy. On certain days the acids formed by combustion rise rapidly, but, as a rule, they fall. Great extremes of dryness and of rain are the best protectives. During heavy showers, the air of Manchester is not unpleasant to breathe. The amount of sulphurous acid sent out is enormous; it cannot be less than 180 tons per day. The rain is acid. It falls on living grass and puts it out. Young plants struggle against it, but they cannot do so long. It is scarcely known how much of the beautiful and useful is destroyed by this acid. The fine arts cannot flourish in an atmosphere which attacks without fear a great building which ought to remain sound for centuries.

The only sure way of diminishing the amount of acid given out by chimneys is by burning less sulphur. This can be done to some extent by burning less coal and burning it more economically. Next, by not allowing the most sulphurous of the coals to be burned in large towns.

The whole argument of Dr. Smith convinces us that two-thirds of the nuisance—so far as dwellings are concerned—can be removed by following the American plan of using stoves instead of fire places.

Farm Gate.

Mr. A. Buckman, of East Greenbush, Rensselaer county, exhibited a model farm gate. It consists of two narrow strips of boards at the top and bottom, between which are held the pickets or perpendicular strips of boards forming the gate. It sets between two posts, the upper bars sliding upon two rollers or pulleys, and when pushed back half way may be swung round. The gate turns either way, and there is no sagging upon the post or liability to get out of order. It makes a very neat and handy gate, and, with this arrangement, no farm need have an excuse for bars, as the expense can be only a trifle more, while the convenience of opening and shutting should commend it to all.

Broadway Underground Railway.

Mr. Samuel Nowlan exhibited a drawing and explained the advantages of the proposed Broadway underground railroad, which provides, also, sheltered sidewalks and another series of stores below the present grade.

Machine for Pegging Shoes.

Mr. J. H. Brown exhibited a machine for pegging shoes; it makes the pegs and drives them in. This machine can peg a pair of shoes in one minute, and will go round the most uneven soles; can make the pegs of any length. The pegs are made of birch or maple wood.

Dr. W. Rowell said that the first pegging machine was made by Thomas Rowell some forty years ago.

Mr. Porter remarked that this machine would enable small manufacturers to compete with the large ones. The machines, it was thought, could be built for ten dollars; the other machines for pegging, and which are very complicated, do not cost less than two hundred dollars.

Professor R. P. Stevens then read the following interesting paper on—

The Hydrographical Basins of the United States, with their Probable Influence upon its Future Destiny.

Eli Beaumont, member of the French Academy of Science, sitting in his cabinet in the city of Paris, first elaborated the proposition that all great mountain ranges describe definite lines of circles upon the surface of the globe. His theory, whether correct or not in its minor detail, is sufficiently so for our purposes this evening.

By these upheaved mathematical circles the dry land was made to appear "the waters were gathered into their place," from whence they could arise in invisible vapors, be condensed upon the mountain tops, irrigate their fertile slopes, and, winding through and watering the valleys, find their way back to their parent source.

The earth was thus made capable of sustaining vegetation, and consequently animal life, and finally to give homes, and fields, and food to the human family.

Hydrographical basins, are, then, the first elements to consider in the economy of nations.

The Rocky mountains rise from the bed of the sea in the extreme south end of the continent of South America, and extend on a line of a great circle northward to Behring's straits, thence southward along the eastern coast of Asia, through Kamschatka, Eastern Tartary, China, Thibet and Birmah, into the Island of Sumatra. It is the grandest and most remarkable of all the mountain systems.

It brought up with it more of the precious metals than all others of both continents. It elevated above the bosom of the ocean the grandest hydrographical basins the geographer is called upon to contemplate. The great valleys of South America, drained by the La Plata, Amazon and Orinoco rivers, the valley of the Rio Grande and Mississippi, with streams flowing north from the same depression in North America, the Amoor, Yellow and White rivers of China, and the Cambodia and Irrawady of Siam, all owe their origin to that tremendous force which elevated this mountain range.

Considering the plains of Mesopotamia and the valley of the Tigris to have been the early home of the sons of Adam, the overteeming population pushed their fortunes eastward, until the Asiatic portion was filled; then, either by accident or design, the red tribes crossed the narrow straits of Behring, crowded down the Pacific slope, and pushing through the defiles of the Rocky mountains, the eastern slope became peopled.

Starting from the same initial point, other tribes emigrated westward and filled the plains of Europe with nomadic tribes, subsisting by the chase. A low forehead, broad-cheeked race, with shaggy brows, who fed on the reindeer, aurochs, rhinoceros and mastadon, and who fought with the great cave bear and cave lion. Not long before the historic period they gave room to a more cultivated people from the mother hive, and these in turn to others, until, in the person of the Genoese navigator, the westward bound emigration met on the coast of the Atlantic, the eastward emigrating tribes who already had reached that impassible barrier to their further progress.

This latter and westward emigration has never ceased to flow. It is now flowing in greater tide than at any time previously. The Santa Maria, of one hundred tons, brought the early wave; the Great Eastern of twenty-seven thousand tons brings the present. It has moulded and is now moulding the history of all other nations.

It is my purpose, in the present investigations, to inquire where and whither this tide of living energy, this mass of reserved vital force, tumultuous with hope and fear, shall flow? What hydrographical basins shall receive, and what the capacity of the various basins to sustain the moving hosts, to develop their powers, and bring forth the inherent strength that is in each individual, and the race collectively.

Mountain masses form the most conspicuous features of continents, and the study of their structure, scenery, geology and minerals, is the most interesting lesson in the curriculum of the geographer.

We shall obtain the clearest conception of the Rocky mountains, by understanding that the great interior of the United States, from the Mississippi river to the Pacific ocean, was at one time in the history of the North American continent, a vast level plain, similar in its physical features, and geological construction with the southern half of New Jersey.

This plain, west of longitude 105° of Greenwich, has been elevated above the ocean from 5,000 feet to 10,000 feet, and maintains a great elevation westward to longitude 125°, where it begins rapidly to fall off in height to the level of the sea. Along this elevated plain, four grand mountain ranges have been pushed through, breaking and distorting the rocky crust of the plain, and carrying up fragments on their steep slopes and summits until their hoary heads are lost in the clouds, or are capped with eternal snow.

The first or eastern range, enters the United States in latitude 30° N, in two parallel systems. One crossing the Rio Grande river, at the Grand Cañon, the other at El Passo, and pursuing a northward course, sends off spurs in various directions. It winds in and about the parks, then trends off north-westwards into the British possessions, and pursues its course to the Arctic ocean. This elevation forms the line of demarcation between the waters flowing east and west.

The second grand range lies west of the main or first range, and consists of numerous short spurs and mountain masses, of which Mintah, Bear, Wasatch, and Humbolat, form the most prominent.

The third and fourth are double ranges, trending off from the sources of the Rio Grande to Point Conception, and from thence are continued northwards in the Coast-range, Sierra Nevada and Cascade mountains through Oregon and Columbia, into the Hudson Bay Company's possessions, where they are finally merged into the Rocky mountain range. Fortunately for men dwelling upon either side of these mountains, they are not continuous, but gaps are left, which show remnants of the original plain, and offer low summits for the passage of emigrant trains, and the future locomotive.

Through the Rocky mountains, there is one in the south latitude, 35° N. at the head of the Pecos river, 30 miles wide, and 7,000 feet above tide. There is another, a little further west, through the Sierra Madre—Camino del Opispo, 8,250 feet high, which opens a passage into the basin of the Pacific. Farther north in the parallel of 38° N. there is the Huerfano pass of 6,099 feet elevation, and the Sangre de Christo pass, 9,219 feet above the Gulf of Mexico. In latitude 41° N. there is Bridger's pass, 7,254 feet, and one degree further north, there is the famous South pass, discovered by Lewis and Clark, 7,490 feet elevation. One can stand in this grand portal to the Pacific coast, and scanning the entire horizon find not a mountain in sight, only low, rocky hills, cut through by waters flowing east and west. The Sierra Nevada have the Madeline pass, 4,079 feet high, and the plateau around Lake Abert 40 miles wide of 5,200 feet elevation. These are in the north, while south there is the Cajon pass, only 3,300 feet above the waters of the Pacific. The coast range is broken through by the Sacramento, Klamath, Columbia and Frazier rivers. The Cascades by Lewis and Clark's forks of the Columbia.

These groups of mountains, thus hastily described, fill up about 1,500 miles in width of the United States, at the point of their greatest breadth, and average about 500 miles wide. They form, then, the most prominent feature of the Continent. The Rocky mountains are the crest of the Continent. By it the east and west slopes were formed of the grand hydrographical basins of the Atlantic and Pacific. The latter, narrow and precipitous; the former, long, wide, and of gentle decline. In an air line from their culminating point, the Colorado and Columbia rivers flow westward 750 and 650 miles, to find the level of the ocean; the Platte and the Missouri rivers flow from the same point, 1,700 and 1,850 miles, to find the same level.

Looking over the western basin, it is broken into a confused labyrinth of mountains and valleys; but looking north or south over the eastern, it is wholly unlike the former, for it is unbroken by any range of mountains from the Gulf of Mexico to the Arctic sea, a distance of nearly 3,000 miles.

At the boundary line between Her Majesty's dominions and our own, a low water-shed extends off eastward, and forms a part of he Coteau du Missouri, and then curving gently southwards enters the State of Minnesota; it now curves around the head of Lake Superior, where it becomes a range of hills or mountains, and

passes eastwards between Canada and Labrador, it terminates at the Greenland sea. This low divide gives the Arctic and Hudson's Bay basins on the north, and St. Lawrence basin on the south.

Rising up from under the great plain first spoken of, the Appalachian range commences in the northeast corner of Georgia, and pursues a northeasterly course, parallel with the Atlantic coast into the State of New York, where it turns rapidly north through Connecticut, Massachusetts and Vermont into Canada; here it turns again eastwards around by the sources of the Connecticut, Androscoggin, Kennebec, Penobscot and St. John's river, and north of Chaleur bay, where it dips under the Gulf of New Foundland, to rise again in the islands of Anticosti and New Foundland, then sinks, and is continued as a sub-marine plateau to the coast of Ireland.

Thus we have the Atlantic slope, long and narrow, on the east, and the Mississippi valley on the west. Commencing at the head of Lake Superior, a water-shed trends away southeast by the south end of Lake Michigan, thence eastwards to Fort Wayne, and hugging closely the south shore of Lake Erie, enters New York State, then turns southeast into Pennsylvania, where it changes its course immediately to the northeast, re-enters New York, and is continued to the Adirondac mountains. Hitherto, it has been the northern and broken edge of a series of plateaus, but here it rises into the most sublime mountain heights of our State. From this, its culminating point, it turns again rapidly southwards around the head of Lake Champlain and its affluents, and at the head of Otter creek, in Vermont, it unites with the Appalachian uplift.

It is thus, by means of gently rising plateaus and swelling highlands, with rugged mountain crests, that we have the following *hydrographical basins*, viz: *The Western, or Pacific; the Northern, or Arctic; the Eastern, or Atlantic; the Middle, or Mississippi, and the St. Lawrence*, which is composed of the three last.

I shall not weary your patience with minutiæ and detail, but rather give you the results of groupings, generalizations and deductions, while I proceed to give the more prominent features and descriptions of each of these great basins, describe their agricultural and mineral resources, and their respective capacities to support the future generations which may immigrate within their bosoms, or be "to the manor born."

Pacific Basin.

A bird's-eye view of the Pacific basin, looking over it from the peaks of the Rocky mountains, exhibit it as a series of broken valleys, separated by short ranges of mountains, generally running in a north and south direction, and bounded on the west by a rim of lofty summits, rising far within the snow line, while the central depression is but two hundred feet above tide water.

The valleys are terribly scarred by the abrasion of their rivers, which, rushing rapidly down from their mountain sources, have excavated through the soft strata of the plains, the most profound and gloomy chasms found on the face of the globe.

That remarkable gorge through which Niagara river flows from the cataract to Lewiston, and into which we gaze from the parapets of the Suspension Bridge with awe and shuddering, is but a mere ditch in comparison with the "big cañon of the Colorado." This excavation is 6,000 feet deep, and is but one of many along Grand, Green and Colorado rivers.

The face of the country is still further disfigured and broken by ejections of lava, which, in quite recent times, have burned and scarred the country.

Vast deserts of alkaline plains lie between the lava ridges, and the smoke from smouldering volcanos still mingle with the clouds of heaven.

In the south-east the hydrographical basin of the Colorado occupies about one-third of the whole.

The annual amount of rain it receives is not equal to the fall of a single shower on the Atlantic coast; hence, the supply of water to fertilize the soil must come from the river. The soil is calcareous and sandy, and when irrigated produces plentifully of such crops as the Mohave and other Indians plant. It formerly sustained a much larger population than at the present, if we correctly judge from the remains of aqueducts and cities along its valleys and hills.

The second subdivision of the Pacific slope is the Utah or interior basin.

It receives its waters from short ranges of mountains, and holds them in lakes having no outlet to the sea, or else its streams are drank up by thirsty sands a few miles from the foot of the hills. It is only where streams supply water for irrigation that supplies of food can be raised for its inhabitants. Into this basin forty thousand religious enthusiasts have found retreat and seclusion,

and there exhibit the moral phenomenon, of a large population otherwise not noticeable, deliberately returning to oriental and heathenish connubial customs. They prove the fertility of the soil by raising twelve bushels of cereals to each inhabitant of its cities and plains.

The larger part of this basin must be written forever uninhabitable, unless fountains in the desert be opened by artesian wells, as upon the prairies of Illinois.

Sacramento Basin.

Lying west of the Sierra Nevada there is a long narrow valley drained by the Salina, San Joachin, Sacramento and Klamath rivers, which is exceedingly fertile, and destined yet to become the great vine growing portion of America. To it the Pacific yields its annual supply of moisture, and its warm winds give a mean annual temperature much above the same parallel of the Atlantic slope. Twenty bushels of cereals per individual is the ratio to its inhabitants, although it has been rather a mining than an agricultural valley. Its capacity to support a population in the future is limited, not by its resources, but by its narrow boundaries.

Columbia River Basin.

This is the largest sub-basin of the Pacific slope, having within it more than 308,000 square miles—more than twice the amount of the southern portion. By the Cascade mountains it is divided into an inner and outer system of valleys. Its mountain ranges are not as high, its river valleys are broader and longer, its streams are more perennial, and its capacity for agriculture greater than the southern. The isothermal line of 60° mean of summer and 40° mean of winter range through all of its valleys, giving it the climate of Virginia, although twelve degrees of latitude further north.

It is estimated by those authorities who have had the best opportunities for forming a correct judgment, that not over one-fourth of the entire 732,000 square miles of the Pacific basin is capable of being cultivated. Its future agricultural population can never be very large when compared with other and more favored portions of the continent We must look to other sources for a dense population. Fortunately we need not look outside of its own bounds.

The mountains which so disfigure the country, corrugate the plains and disturb its rocks, and rising into the clouds arrest the moisture wafted eastward, have their inner and secret recesses filled with treasures so rich and varied, and scattered with so liberal a hand, that the fables of Arabia seem tame with the actual and real. Gold, silver, cinnabar, copper and other metalliferous veins, seem to stud the mountain strata with profusion scarcely to be appreciated, and challenge the faith of conservative minds.

The hidden and future wealth of all this country lies in its mines. These must be developed. Mining has been and must be the staple business of its inhabitants.

In 1848 gold was discovered at Sutter's Fort, on the Sacramento. Our coinage that year was nearly $6,000,000. In 1849 it rose to $11,000,000; the next year to $34,000,000, and in 1863 it reached $83,000,000. During this period we have produced over $600,-000,000 of gold and $100,000,000 of silver. Nearly the whole of this vast amount has come from the Pacific slope. The population that has produced, upon an average, $47,000,000, has been but 443,000 up to 1860.

Let us look forward in time to a period where the population of this mining country par-excellence shall be equal per square mile to the mining portion of England; and surely the mountains of the Pacific slope are not less capable of supporting population than the mountains of Wales or Cornwall. We shall have there 100,000,000 of human beings deriving their main support upon the mineral wealth of this greatest auriferous region of the entire continent. Let us farther suppose that the same ratio per head of yield of precious metals shall continue, and the product will then be *one thousand millions of dollars* per annum.

According to the ratio of the increase of its population at each decennial census, this enormous yield of precious metals will be attained in far less time than has elapsed since Sir Francis Drake discovered this region, and made the remark, "that there was no part of the country wherein there was not some special likelihood of gold."

During the year last past, it is estimated that California has produced $25,000,000 of gold; Nevada, $16,000,000 of silver and gold; Idaho, $17,000,000; Montano, $18,000,0000; Colorada, $17,000,-000; Oregon, $8,000,000; New Mexico and Arizona, with other sources, $5,000,000, making a sum total from the auriferous regions of the west, of $106,000,000 of bullion. Permit me parenthetically

to remark, it is not written in the book of fate that a people so youthful, and yet so strong as ours, so instinct with vitality, possessed of such noble enthusiasm, though sometimes misguided, endowed with so rich and varied resources of field and flood and mine, and fully capable from its own internal forces of fully realizing the glories of its economical future, already foreshadowing the horizon—a people that has twice extinguished its national and war debts, and nobly loaned its government *four thousand millions* of dollars to secure its domains intact, will stagger and falter under the load of its repayment, and finally repudiate the liquidation of its bonds.

Surely, the people who could find means and ways to create and loan, can devise means to repay. The horizon may not now be clear, financial mistakes may be made, some schemes may fail; but as in the past, so also in the future, no man will ever hold in his hand one single sheet of *repudiated government paper*.

Basin of the St. Lawrence.

This basin extends from the Atlantic westwards through thirty degrees of longitude, or 1,300 miles. In width it varies from fifty to three hundred miles. Its geographical area is about 450,000 square miles; 100,000 lie within our own limits. Fully three-fourths of the whole is in a state of wilderness, but studded with most magnificent forests. Its elevation on the north is about 1,000 feet; on the northwest, 1,800 feet; south and southwest it ranges from 660 to 2,200 feet, and in the southeast of the southern portion it rises into lofty peaks of 5,067 feet above tide. By reason of its low southern rim, it has an easy transit into the valleys of Mississippi, Ohio, Mohawk and Hudson rivers. It presents the appearance of a long narrow valley, trending in a southwest direction to the head of Lake Michigan, then bending northwest, is finally merged in the broad plateaus of the interior of the continent.

Its northwestern rim holds metaliferous veins of copper, iron, silver, lead and gold. Within its bosom it has vast stores of coal, gypsum and salt. Its northern and southern mountains have supplies of magnetic iron ore, sufficient for the world. Its southeastern rim has veins of gold, copper, lead and other metals in large abundance. Of such minerals as most conduce to man's comfort and welfare, none of our hydrographical basins are more richly blessed than this.

Throughout its eastern half, rich pasture lands obtain; and be-

ginning in Oneida county, there runs westward through it a broad belt of wheat growing soil, which extends to its western limits.

The commerce of the Canadian portion is already with us \$50,000,000, and our internal trade is three times this amount. 200,000 of its population live by its mines, and the number will be much increased in the future. The capacity of the Canadian portion to hold a large population is much restricted by the close proximity of the barren and desolate Laurentian mountains of Labrador.

The Canadian portion doubles its population in seventeen years. When the Atlantic and Mississippi basins shall hold their 260,000,000 of people, this basin may have its 20,000,000.

The natural tendency of all its commerce west of the St. John's river, which seeks a facile and certain transit to the sea-board, is by the Valley of the Mohawk, or Lake Champlain. All the artificial communications of its internal traffic equally tend thitherwards. So long as winter frosts shall close the mouth of the St. Lawrence five months of the year, its main outlet to the sea will be by the Valley of the Hudson.

Atlantic Basin.

This basin reaches through 28° of longitude, and 20° of latitude. Its contour is that of a long narrow slope, extending in a northeast direction about 2,700 miles, and from 200 to 500 miles broad. Its northwest rim is the Appalachian mountains. From this crest its streams descend rapidly to the sea shore, giving more than *forty* sub-basins of the most delightful scenery, highly improved by taste and art, and fertile valleys teeming with commerce and manufactures. In them are the great commercial and manufacturing centres, and nearly all the manufacturing establishments of the country.

In this latitude the Appalachian mountains lie in three distinct and parallel ranges. The outer known as the Highland; the inner as the Shawangunk; and the western as the Cattskills, farther south as the Alleghany mountains.

The former culminate at West Point, and here the Hudson river finds passage through them. This range lies in short parallel ridges of short extent, with their termini shot by each other, and separated by narrow and beautiful cloves, or valleys. Lying west of them is the "Great Valley," co-extensive with the whole range from Georgia into Canada.

It was by this peculiar echelon arrangement, with its cross valleys, and great lateral valley that Washington was enabled to deceive Lord Clinton, and availing himself of this natural screen, move his troops from the Hudson to the Potomac, and at Yorktown terminate the war of the Revolution.

The outer range in its upheaval brought up with it the precious metals in great profusion ; and iron in largest measure. Enough of this metal so essential to civilization, lies within a few miles of this city to last our country many centuries.

The second range brought up lead, zinc and copper. And the inner the well known anthracite coal of Pennsylvania, and a few detached outliers of bituminous coal.

The whole range abounds in water power in such super-abundance, that at the present time not one-eighth of it is utilized. Marbles of rare beauty are hidden in its recesses, while brine springs gush forth from its ravines and valleys.

Its culminating peaks rise 6,476 feet above the level of the sea, giving a clime oxygenated and cool for the lassitude of summer at its feet.

On its southern flanks are lowlands growing rice and cotton, the staples of the mildest temperate climates. Its middle slopes grow tobacco in such wonderful exuberance, that after supplying our inhabitants, if our English cousins, so highly enamored with free trade, will sedulously keep down the interest on their national debt, and faithfully devote their present revenue from tariff on this article, within one hundred and fifty years it will extinguish their national indebtedness.

Along the northern slopes of this valley rich pasture lands abound. Oats, hay, and rye are the staple products. Sheep and other live stock abound in greater proportion to its inhabitants, than any other portion of our country. Its butter and cheese have a world-wide celebrity.

What is to be the future of its inhabitants ? What the population it is capable of supporting ? Passing over as much ground as this paper does, I cannot go into the special capabilities of each State in this basin, but look upon them as a whole.

Owing to the rapid increase of its manufacturing capabilities, and the emigration of its youthful agriculturists westwards, it does not now raise its own bread stuffs. It cannot feed its own inhabitants, and it will fail to do it more and more in the future. Its sons, then, must be men of commerce, trade, manufactures and

middle men. It is to be the workshop of the country. For this purpose it has all the elements of success. Accumulated capital, skilled and intelligent man power, abundance of water and heat force, a boundless before, and a net work of communication, within and lying back of it unparalleled among men, and last, but not least, intelligence and enterprize to plan and execute, which will surely elevate it to the highest point in commerce and manufactures.

When this basin shall have the ratio per square mile of inhabitants, as the State of Massachusetts, it will be filled with the homes of 50,000,000, and twice this amount when it attains the ratio of Great Britain. The ratios of its manufactures is as three to one, compared with other basins. The tonnage of its commerce vastly exceeds all other portions. When its manufacturing population shall be in ratio with Massachusetts, its annual amount of manufactures will be the enormous amount of *five thousand millions of dollars.*

Mississippi Basin.

This vast expanse of fertile land, reaches through 36° of longitude, and 24° of latitude; or 2,200 miles east and west, and 1,500 north and south. From the mouth of the Mississippi river, as our stand-point of vision, and looking northwards, it presents the appearance of an expanded fan, with the basin of the St. Lawrence making a deep intendure into its northeastern rim. The Mississippi flows from the north, southward, through its eastern third. The Ohio, and its affluents drain its eastern rim, while the Missouri, and its branches, the Arkansas and Red rivers, with the Rio del Norte, drain the western two-thirds. The ascent of the Mississippi is gradual up to 800 feet above the level of the Gulf of Mexico. Ascending from this low depression the rise westward is very gradual to the base of the Rocky mountains, or about 8,000 feet above the sea. At this point peaks in the western rim shoot suddenly up 14,000 feet, while the whole rim averages about 12,000 feet. The eastern rim attains a more gentle height of only 2,500 feet, but some peaks tower above this elevation, 3,000 feet higher.

Its great range of latitude enables it to raise all varieties of crops from tropical sugar, and cotton, through the isothermal lines of vines, wheat, and grass, to polar oats.

Its meteorological range is so great, that if drought, or frost, or extreme moisture visit any one portion of it, so seriously as to

endanger its vegetation, other portions will escape. Full one-third of its area is adapted to the growth of wheat, one-sixth to cotton, one-half to grass, and three-fourths to corn.

Some portions of it, as the Llano Estacado of Texas, the bad lands of Nebraska, and the sand hills of Kansas and Colorado, may be said to be barren, though they yield grass a large portion of the year to vast herds of buffalo, elk and antelope. Its western heights are blessed with richest lodes of gold, silver, lead, copper, antimony, tin, cinnabar and iron. Within its bosom are the most extensive lids of bituminous coal on the face of the globe. Its limestone caverns are filled with galena. Rock salt and gypsum glisten on its plains. Brine springs and oil springs gush from its sandstones. Precisely in its centre is fixed the most wonderful and grandest upheave of iron that man has ever gazed upon. Its navigable waters exceed those of all the rest of North America. There is no timber, no grade of soil, no ore or mineral, no want in man's industrial pursuits but here it can be supplied. Man has no earthly want that cannot here be gratified. Here is the greatest network of railroads; here the longest bridges. Cities spring up and grow with the rapidity of the prophet's gourd. Men here become millionaires before the frosts of years has tinged their whiskers. Oil to fill the lamps of mankind is drawn from its rocks, and food to feed the world from its virgin soil. Where you sleep to-night, to-morrow may see an embryo city. Where you may have roasted ears of corn, a Commodore Foote has sailed his gunboats. Twenty-one railroads touch the Hudson; sixty-six touch the Mississippi. Eleven roads centre in New York; fifteen in Chicago. This grandest valley of the globe can receive the present flow of hungry emigrants from Europe, and give them the elemental conditions of civilization through one hundred and fifty years, and then not be filled to repletion. It is thirty times as large as the State of New York, and seven times as large as the original thirteen States.

The steamer St. John leaves her wharf at six o'clock P. M. of a summer's afternoon, and lands her refreshed passengers in Albany at six o'clock of the following morning—a transit of one hundred and fifty miles. Could she pursue the same rate of speed, she would consume thirteen days, or twenty-six times the number of hours in her voyage from Pittsburgh to the Rocky mountains. Should she push her prow with undiminished speed, and pausing not in her course, through all the navigable waters of this valley, three

months of time would be consumed in her trip. During this, her imaginary voyage, she will have visited one thousand millions of acres of land, blessed with the most prolific soil in the Eden of our Lord.

When the census takers of 1790 numbered the people, they did not find west of the Alleghanies a population large enough to be worthy of a separate statement. Ten years thereafter there were but 386,000. In 1860, the voting strength of the nation had passed the mountains. Its fighting strength has decided the issue of every battle of the last rebellion. Its warriors outnumber the east as twelve to seven. Thither the destinies of the nation have passed and passed forever. The sons of its broad valleys henceforth hold control in the councils of the country. They are to-day our rulers.

What will be the number of its people—what their character, pursuits and enterprises? The able superintendent of the last census estimates the population of our country will be at the close of this century 1,000,000,000, being an increase of 70,000,000. Of this increase, eighteen per cent will be in the old mother States, and 270 per cent. in the valley of the Mississippi. Her vote in the National Congress will be a clear constitutional majority. The majority of her sons will be engaged in agriculture; a large number devoted to mining, arts, commerce and manufactures. Emphatically, her people will be cultivators of the soil.

That very far-seeing and sagacious financeer of the Revolution, Robert Morris, with almost prophetic vision, in 1800 wrote to a friend as follows: "Shall I lead your astonishment to the verge of credulity? I will. Know, then, that one-tenth of the expense borne by Great Britain in the last campaign would enable ships from London to sail through Hudson's river into Lake Erie. As yet, my friend, we only crawl along the outer shell of our vast country. The interior excels the part we inhabit in soil, in climate, in everything. The proudest Empire in Europe is but a bauble compared to what America *will be*, *must be*, in the course of two centuries, perhaps in one."

The following queries, it appears to me, must be apparent to every thoughtful New Yorker: Shall the products of so vast a country, having such bright prospects of the future, and whose sons are so flushed with the hope and enterprise of youth, together with all their inward bound commerce, pass through New York, and be tributary to its growth and greatness? Or shall this city,

being flanked by the St. Lawrence and the Mississippi, fail to secure the trade of the future, and dwindle to a third rate town?

To hold the trade already secured, and make sure of the future, Robert Morris' idea of an artificial river must be realized. The navigation of the Erie canal must be made equal in capacity to the obstructed capacity of the St. Lawrence.

Facilities for transshipment, storage and handling the products and merchandise of the country must be so complete and perfect that this item of expense may be reduced to the lowest possible minimum.

I was born west of the mountains, and am but in the meridian of life, yet have seen villages increase to cities—like Rochester, Buffalo, Cincinnati and Chicago, the latter boasting its 250,000 inhabitants. I have seen the wilderness give place to fertile fields, and their products, a free gift, feed the famishing children of the mother island. I have seen a whole State cease in one year to be the importer of its food, and become an exporter to the amount of many millions. On the spot where, in 1855, I ate my lonely meal, without a house in sight, that self-same day, a twelfth month, I dined in a village of 1,500 inhabitants, with all the luxuries of an eastern city.

In 1822, Andrew P. Tillman erected in the village Geneva, Ontario Co., N. Y., a block of six brick stores, three stories high; it was the wonder of the western world, for its equal was not to be witnessed between Albany and the Pacific. The year before, the cost of transportation had been reduced from that point to this city from $100 per ton to $25 by the Mohawk Improvement Company. The Erie canal has since reduced it to $2 per ton.

Since then what has the west become? To what height of prosperity has it reached? What a glorious prospect looms up before it.

Through much tribulation Providence led an ancient and oppressed people into the narrow hydrographical basins of the Jordan, and the eastern slope of the Mediterranean. He has opened a grander theatre for the evolution of the problems of humanity, by leading our fathers into this goodly land.

When the young giant of the west was in the gristle of its youth, England felt its power at New Orleans, under the hero of the 8th of January; and though not yet consolidated into the strength of manhood, under Sherman the knight of action and impulse, and Grant, the knight of silence and work, the problem

of the great rebellion has been safely settled, and the oneness of the nation forever fixed.

Is it too much for the patriot to toil for, and confidently await the result of his labor, and the christian to pray and look for the fulfillment of his petition, that the sun, in his daily course, may never set upon a divided people? That, when our country shall teem with population in ratio equal to the multitudes upon the square mile in Europe, our congregated hosts, though gathered in from the oppressed of all peoples, yet shall be *one people*—AN AMERICAN NATION? That the sun, in his golden course, shall look look down upon its myriads of individuals, elevated to the highest condition of humanity, and blessed with the peaceful principles of an exalted, christian civilization?

Adjourned.

AMERICAN INSTITUTE POLYTECHNIC ASSOCIATION,
March 14, 1867.

Prof. S. D. Tillman in the chair; Mr. T. D. Stetson, Secretary.

The Chairman opened the meeting with the following notes on scientific progress:

CHLORIDE OF THIOXYL.

Prof. Wurtz, of the College of France, has formed this compound by the direct union of anhydrous hypochlorous acid with sulphur. Representing an atom of oxygen by *at*, and an atomoid by hypochlorous acid by *edat*, on adding to it an atom of sulphur (*as*) we have *asted;* which shows very clearly that this body consists of one atom of sulphur, one of oxygen, and two of chlorine.

SPECTRUM OF THE VAPOR OF WATER.

Mr. Janssen, under the patronage of the Minister of Public Instruction of France, has, by a series of experiments, proved that certain lines in the solar spectrum of variable intensity, first discovered by Sir David Brewster, and termed by him telluric rays, are not caused by water in solution in the atmosphere, but are the direct effect of water vapor as had been previously conjectured by Father Secchi. When light is passed through a tube filled with vapor under the pressure of seven atmospheres it shows the principal telluric rays. Janssen dissents from the conclusions of Kirchoff who attributes a portion of the lines in question to potassium. The red and yellow being found more brilliant

than the blue and violet in the spectrum of water-vapor, the color of the vapor should be orange; this also accounts for the red of the rising and setting sun, or the sun when seen near the horizon.

A Remarkable Spring.

Near the center of Marion county, in the State of Florida, is a wonderful fountain called Silver Spring. Out of the rift limestone flows a stream, forming a branch of the winding Oclawaha, which is so large that a steamboat comes up to its source and turns about on the stream to go down the next day. A correspondent of *The Liberal Christian*, who has lately visited the place, describes it as a literal fountain 500 feet in width and pouring out 30,000,000 of gallons per day; enough to supply ten cities like New York. The glory of this spring is its transparency. Floating on its surface you shudder to look over the edge of your boat. You seem suspended in mid-air. The bottom is near seventy feet below you, but every shell, however minute, is distinctly visible. Multitudes of large fish glide about, seeming miraculously upheld. Occasionally a huge alligator peers out, but retreats from the light into the wonderful tangle of water plants which fringe the great basin. Cliffs of limestone rise from the bottom almost to the surface. At their base huge rifts show where the vast and unvarying flood wells forth. A delicate pearly white tinges every stone, shell, and twig; while in deeper places, or before the rising and declining sun, the most exquisite tints of green and blue continually lurk and shift and fade. This place is the commercial outlet of a rich country, and Northern enterprise could easily make it a delightful winter home for northern invalids.

A Normal Map of the Solar Spectrum.

Prof. Walcott Gibbs, of Harvard University, in a memoir read before the National Academy of Sciences, described his Normal Map of the Solar Spectrum, in which each spectral line is entered according to its wave length as first suggested by Billet. The well known Chart of Kirchoff, though executed with great care and labor, is not, properly speaking, normal, since it only represents a spectrum formed by four flint glass prisms, the angles of which, it is true, are given, but of which the indices of refraction are not stated. Moreover the prisms were not placed accurately in the positions, of least deviation for each of the spectral lines. Prof. Gibbs obviates these objections by making a standard map

wholly independent of the peculiarities in the form of apparatus, in the number of prisms, their refractive and dispersive powers, and their positions. His map is based on the wave length of spectral lines, which do not vary with the material of which the prism is composed. Angström's measurements were selected as standards; these being in ten-millionths of a Paris inch have been reduced by Prof. Gibbs to millionths of a millimeter. A new method of determining wave lengths by comparison was described by the author. The chart accompanying his paper contained the wave lengths of 187 lines, with a probable error not exceeding two millionths of a millimeter. The lines being ruled by a dividing engine upon a copper plate are correct upon the chart to about one-tenth of a millimeter.

New Mode of Killing Whales.

The chief danger attending whale-fishing has been removed by the invention of M. Thiercelin of France. Instead of fastening to a whale by means of a harpoon, the inventor fires into the animal an explosive shell within which is a deadly poison, made by mixing a salt of strychnine with 1-20th of the Indian poison called curare or wourali, the origin of which is not definitely known, but which occasions a general parlysis, and by controlling the organs of respiration, proves fatal. Wourali, or, as it is sometimes called, woorara, when absorbed by the blood, has the effect of relaxing the muscular system, while strychnine, on the contrary, produces an excessive contraction of that system. The remarkable effect of a conjunction of these two agents is to occasion almost instant death, if administered in a dose of half a milligramme per kilogramme of the animal's weight, provided the weight does not exceed ten kilogrammes. If larger, the dose must be proportionately increased. Thirty grammes (one ounce) is enough to kill an animal weighing 60,000 kilogrammes. In a late whaling voyage ten whales received M. Thiercelin's missiles, and all died within from four to eighteen minutes after they were wounded. These animals were cut up and their remains handled by men who had scratches and sores on their skin, without the slightest injury, thus proving that the poison cannot be transmitted from marine mammals to man.

Platinum.

The heaviest and one of the most infusible of metals, platinum, has lately been discovered in large quantities in New Zealand.

Geology in our Public Schools.

Prof. Agassiz has called attention to the fact that Geology is not yet made a part of our elementary education. *The American Journal Mining*, in commenting on this statement, shows the importance of teaching the wonderful procession of processes by which the Father of the Universe created this planet; and that even taking a more grovelling view of the case, it is plainly to our advantage in this world, and particularly in this section of it—not morally nor mentally alone, but *pecuniarily*—to have some knowledge of geology and its companion mineralogy; the more the better. This country contains more mineral wealth than any other on the globe. To teach where to find it, and how to recognize it when found, should be one of the aims of all our schools. Many a princely fortune has slipped through the fingers of our citizens for lack of such knowledge.

Classification of Meteorites.

Prof. C. W. Shepard, of Amherst College, has newly arranged meteorites in three clssses, viz.: 1. Litholites, or stony, the word being derived from the Greek word *Lithos*, a stone. 2. Lithosiderites, or mixed stone and iron; from the Greek *Lithos* and *Sidcross*, iron. 3. Siderites, consisting chiefly of iron.

The first class Litholites embraces three sub-classes. 1. Eutrictic, or distinct earthy individuals; crystalline. 2. Dyscritic, or indistinct earthy individuals. 3. Anthracite or black.

The second class Lithosiderites embraces two sub-classes. 1. Pleiotholithic, or more than half stony. 2. Meitholithic, or less than half stony.

The third class Siderites includes two sub-classes. 1. Psatharic, or brittle. 2. Apsatharic, or tough.

Each of these sub-classes is subdivided into several orders, which cannot be here enumerated. Under these orders he has arranged two hundred and eleven varieties, stating when and where each was found.

Under the head of meteoric minerals he enumerates eighteen species which are supposed to have existed in meteorites anterior to their arrival within our atmosphere.

Waste of Coins.

The life of coins is said to be much briefer now than before the introduction of steam for passenger travel. The real cause of the increase of wear in Europe probably arises from the fact that coins are not saved and secreted as they were formerly. Now they are subjected to constant attrition by being carried in pockets and passed from hand to hand. On the average one hundred old English shillings would not make more than eighty new ones.

The mode of manufacturing coins is opposed to their longevity. The plain disk of metal is very soft when placed between the dies. Compression hardens the recessed surfaces, while the raised surfaces are left in a state very near their original softness. Unfortunately, the raised portions of the coin are just those most exposed to attrition. It has been proposed to raise the rim of the coin so as to protect the figures within. This plan might make the denomination of the coin legible for a longer time, but would not diminish the actual wear. Our copper and nickel coins never bear the intrinsic value they represent, so that there is really but a trifling loss by attrition. Gold and silver coins, on the contrary, are originally worth their nominal value, and any plan to better protect them from wear, when they again come into general use in this country, should be favorably entertained by the general government.

Cameras.

M. Carey Lea, of Philadelphia, says American cameras are usually made of wood, a material liable to great objections—the most prominent being the warping it undergoes in our changeable climate. He has seldom found one absolutely correct in its construction. An important requisite in a camera is that the sensitive plate should be exactly perpendicular as to the optic axis of the lens, otherwise, while one side of the plate is in true focus, the other will not be strictly so. On a cursory observation the whole may appear to be in tolerably good focus, but a careful examination with a glass will verify the difference. In English made cameras the focusing-screen and dark side usually slip into a groove, while in those of American manufacture dowels are fastened into the bottom of the camera, and fit into holes in the slides, which close up by a spring-catch at the top. The latter plan is liable to become loose and unreliable by wear. Another fault is the allowing of too much play in the rack and pinion by which distance is

graduated. Mr. Lea thinks the whole instrument would have great precision in working, were it made of metal instead of wood. We hope some American mechanician will remedy the evils complained of, and provide photographers with an absolutely correct camera.

The Camel in Australia.

The camel has been introduced into Australia, and has proved well adapted to the dry regions of that country. In a recent expedition, seventy horses, fourteen camels, and fifteen men were employed. The springs upon which they depended for water having dried up, the horses fled; the men resorted to their stores of spirituous liquors, while the camels traveled on without drink. The caravan was thus enabled to continue its journey until they reached Thompson river.

Dangerous Toys.

In Europe the rage for Pharaoh's serpents, a scientific toy consisting of the sulpho-cyanide of mercury, had hardly been checked by showing that it could not be burned without the disengagement of dangerous fumes, when another mischief-making plaything appeared under the name of "Devil's tears." They consist of a little oval capsule covered with cotton and a thick layer of varnish; inside the capsule is a little pill of coarse paste made up apparently of the metal potassium. At a little distance they resemble red sweetmeats or red berries, and might easily be mistaken by a child, not old enough to read the directions, and swallowed, which would produce instant death. "Juno's tears" and "Witches tears" are imitations containing the metal sodium. Either of these metals have such a strong affinity for oxygen that they will abstract it from water. The capsule dances about on the surface of water while burning, and often throws among the wondering spectators red hot globules of the hydrate of potassium.

Artificial Limbs.

We gave in the last volume of the Transactions of the American Institute, very full descriptions of nearly all the best artificial limbs invented and made in this country. Under the act of Congress providing limbs for soldiers, passed July 16, 1862, there have been supplied up to July 1, 1866, 3,981 legs, 2,240 arms, 55 hands, nine feet, 125 surgical apparatus, and it is supposed about one thousand limbs are yet to be furnished.

To Prevent the Fading of Photographs.

It is well known that the spontaneous decomposition of the hyposulphites used in fixing the photographic picture is one of the chief causes of fading. Several processes have been proposed for remedying the evil, but none seem to have answered the purpose. Recently, Messrs. Tichborne and Robinson of Dublin, Ireland, have devised a process to elminate the hyposulphite without producing any counterbalancing injury. It consists in washing the print in a bath composed of a mixture of baryta and perchloric acid. This mixture has the effect of removing all traces of hyposulphite without generating any deleterious compound or disengaging free chlorine gas which would attack the metallic silver in the pictures.

The Pipestone Quarry.

In a sketch of the geology of North-Eastern Dakota, communicated to the *American Journal of Science and Arts*, by F. V. Hayden, will be found a full description of this celebrated Indian quarry. From Fort James, a point on the James river about 65 miles north of Yankton, the capital of Dakota territory, the writer proceeded in a direction nearly east for 63 miles to Fort Dakota, at Sioux Falls on the Big Sioux river, where he found red and variegated quartzites similar to those seen on the James river. The falls are five or six in number, extending a distance of half a mile, and have a descent of 110 feet in all, forming the most valuable water power he had seen in the west. About ten feet from the top of the rock, as seen in this locality, is a layer of steatitic material, mottled, gray and cream color, very soft, about 12 inches thick, which is sometimes used for the manufacture of pipes and other Indian ornaments. From Sioux Falls to the Pipestone quarry is just 40 miles, measured with an odometer; direction, a little east of north. The quarry is located on Pipestone creek, and the quartzites here assured Mr. Hayden that the rocks were of the same age as those on James river and Sioux Falls. The layer of pipestone is about the lowest rock that can be seen. It rests upon a gray quartzite, and there are about five feet of the same quartzite about it, which has to be removed with great labor before the pipestone can be secured. The pipestone layer is about 11 inches in thickness, only about 2¼ inches of which are used for manufacturing pipes and other ornaments. This rock possesses almost every color and texture, from a light cream color to a deep

red, depending upon the amount of peroxyd of iron. Some portions of it are soft, with a soapy feel, like steatite; others slaty, and breaking into thin flakes; others mottled and gray. A ditch from four to six feet wide and about 500 yards in length, extending partly across the valley of Pipestone creek, reveals what has thus far been done in excavating the rocks. There are indications of an unusual amount of labor on the part of the Indians in former years to secure the precious material. Nearly all of our writers on Indian history have invested this place with a number of legends and myths. They have represented the locality as having been known to the Indians from remote antiquity. It is quite probable, however, that the rock has not been known to the Indians from 80 to 100 years, and, perhaps, not even as long a period. There are many rude iron tools scattered about, and some of them were taken out of the ditch last summer in a complete state of oxydation. Prof. Hall regards these quartzite rocks as of the same age as the Huronian series. Mr. Catlin, who first gave a detailed account of this quarry, sent a specimen to Prof. C. T. Jackson, of Boston, for analysis, and the following is the percentage composition of this rock to which the Professor gave the name Catlinite: Silica, 48.2; alumina, 28.2; water, 8.4; magnesia, 6; peroxyd of iron, 5; oxyd of manganese, 0.6; carbonate of lime, 2.6 (probably magnasia), 1; total, 100.

Extracting Perfumes.

The bisulphide of carbon, a very volatile, colorless liquid, of a fœtid smell, readily dissolves the essential oils of flowers, to which they owe their agreeable odor. M. Schnaiter's process for obtaining perfumes is to fill a large phial with the petals, just gathered, of the flowers he wants to operate upon, and having poured upon them a sufficient quantity of bisulphide of carbon (sulphuret of carbon) to cork the phial, shake it and let it stand. The bisulphide penetrates into the substance of the petals and expels the water they contain, which goes to the bottom. After six days' masceration, the bisulphide of carbon, charged with the essential oil of the flowers, is decanted into another phial containing fresh flowers, and this operation is repeated four times, after which, if the quantity of flowers is considerable, the bisulphide will be highly colored. It is now necessary to separate the bisulphide from the perfume. If the quantity be small, it may be left in the open air, by which the volatile bisulphide will soon be evaporated, and the

residue is then to be treated with alcohol, having the strength of about eighty-three per cent. This process can be performed by any farmer's daughter, but when the amount to be made is very large, the oil of almonds should be added to the saturated bisulphide, and the whole distilled at a very low temperature, so as to save the bisulphide, and the residue is treated with alcohol, as before described.

Dr. Hirsh remarked in relation to this item that the odor of bisulphide of carbon was objectionable, and it was found more convenient to use benzole.

Fire Damp.

The cause of explosions in coal mines so destructive in Great Britain, is the accidental ignition of air containing light carburetted hydrogen, or garol, which the miners call fire damp—a gaseous compound, consisting of twelve parts by weight of carbon, and four parts of hydrogen. In the process of mining, crevices are opened containing this gas, which, by the law of diffusion, soon becomes equally mixed with the whole air of the mine. It is well known that diaphragms of animal matter possess the property of absorbing this gas by endosmosis. An empty bladder, for instance, suspended in a mixture of air and marsh gas, will soon be found partially filled with marsh gas. Unglazed earthernware may be substituted for the animal membrane. Mr. G. F. Ansell, of the Royal Mint, London, first applied the principle of osmosis in a very ingenious instrument for the detection and quantitative estimate of explosive gases, which can be used in mines to give warning of the presence of marsh gas in such quantities as to form an explosive mixture. For certain reasons, which need not here be explained, the diffusion of gases is not always equal. Several of these instruments, at different heights in the same mine, show that there may be a much larger percentage of marsh gas at the top than at the bottom of the gallery. Mr. Ansell has lately improved the apparatus constructed by him in 1865. It now consists of an iron funnel, provided with an iron U-tube, the end of which is closed by a piece of glass tube fixed in brass, to which one pole of a battery is attached ; the upper part of this glass tube carries a brass collar, through which passes an adjusting screw, to the lower end of which is fastened a piece of copper wire with a platinum point. Mercury is poured into the iron funnel till it rises in the glass tube to a convenient height. This mercury is

allowed to find its level by opening a valve when setting the instrument. The top of the funnel is closed by a septum, consisting of Wedgewood's ware, secured in its place by common sealing wax. The other end of the battery wire is connected with the instrument. When the apparatus is placed in a mixture of common air and marsh gas, the latter passes through the septum more rapidly than the air within the apparatus can escape, according to the well known law that gases diffuse into one another in the inverse proportion of the square roots of their specific gravities. The accumulation of marsh gas within the septum, therefore, increases the pressure on the mercury in the funnel, and thus raises it in the leg of the U-tube, until it touches the platinum point, when electric communication is established, and the alarm is given by means of a bell having wheel work for moving the clapper, which is set in motion the instant the circuit is closed. Mr. Ansell has found his instrument gives warning in four seconds, if the mixture of gas is still below the point of explosion, but, by adjusting the point so that there is not more than the thickness of a shilling between it and the mercury, a dangerous irruption of gas may make itself known in two seconds.

Although this apparatus is said to be efficient, it has not yet been generally adopted. Some superintendents of mines assert that the flame of the safety lamp becomes dull in the presence of marsh gas, and thus warns them of danger, but the numerous accidents in mines prove that such warning is disregarded.

A French savant has suggested the use of Ruhmkorff's induction apparatus for illuminating the galleries of mines, by which ordinary lights would be dispensed with, and all danger of explosion avoided.

THE HARRISON BOILER.

Mr. J. Burrows Hyde read the following paper descriptive of the cast iron steam-boiler invented by Joseph Harrison, Jr., Esq., of Philadelphia:

This boiler is constructed by uniting or building up a requisite number of cast iron hollow spheres, provided with hollow necks or unions, made to fit by close steam tight joints, and so connected as to form a rectangular slab or section of any convenient capacity.

The globes are all of uniform dimensions, being eight inches external diameter, and three-eights inch thick, the union necks

being three inches diameter, and one and a half inches long, flaring outward to their junction with the sphere. The ends of those necks are machine-turned, with rebate joints, in such precision as to be interchangeable to an infinite degree, easily put together and as easily dissected. They are usually cast in sets or units of two and four globes each, united in each case in the casting, by necks at right angles with the union necks before described.

In composing a boiler section in the works, a strong platform on wheels is provided, of proper dimensions, upon which vertical rests are secured at proper intervals, to fit and receive the spheres, which are laid into the recesses and fitted together, a two globe unit and a four globe unit in line, transverse with the section forming a width of six spheres. The next line is varied by placing a two globe unit parallel with one of four in the former case, the third line being a duplicate of the first, and so on until the number—usually twelve series—is completed, but terminating at the bottom end of the slab with a four globe unit only, and this placed at one side. See Figs. 1, 2, 3, 4.

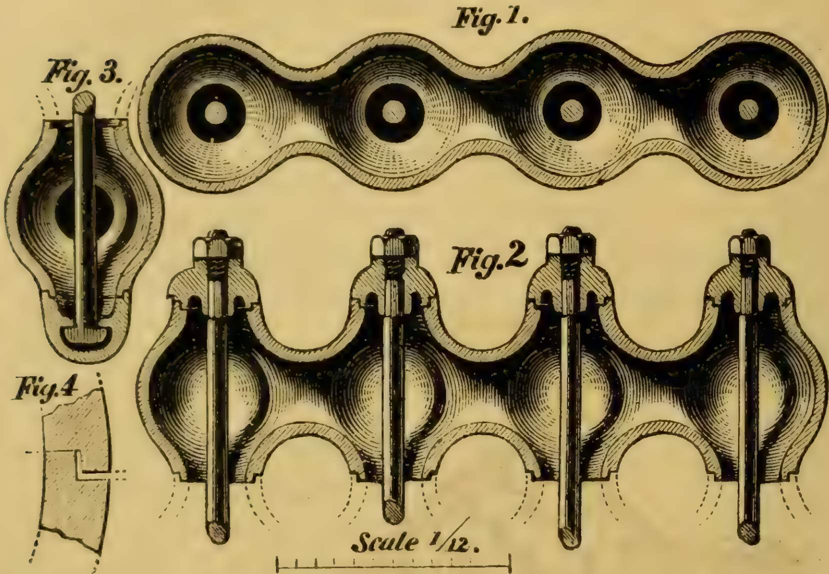
The outer spheres of the units have but three necks, being closed at their extreme ends. Round iron rods are now passed through the globes by the open necks. At the lower end a strong cast iron cap or hood, fitting the neck of the sphere, is secured to the rod; a cap of different shape is fitted to the opposite end of the rod, on which there is a screw thread, taking a strong nut, which, being properly tightened, binds the whole together.

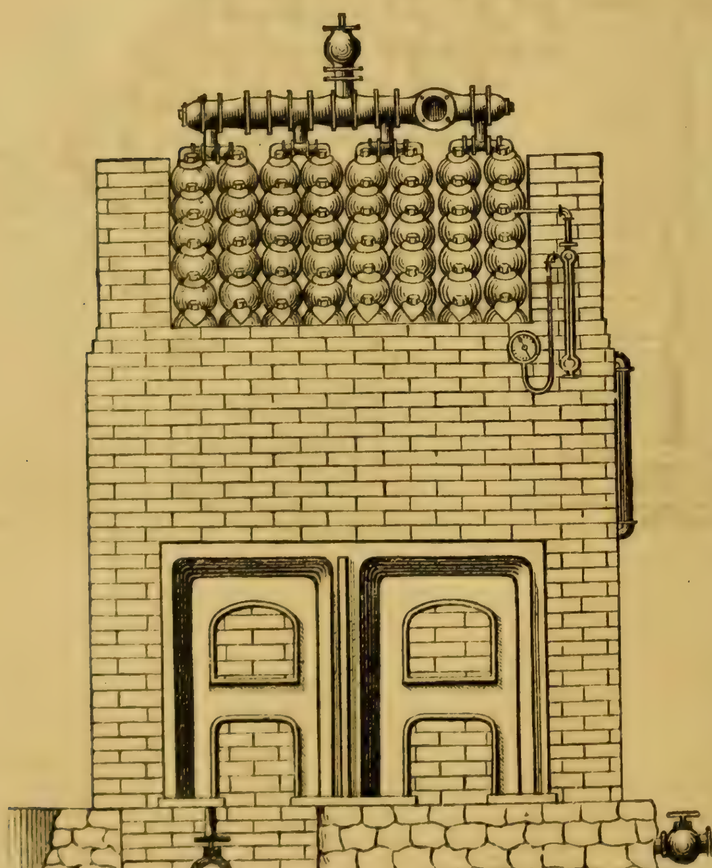
The platform or truck is then moved to the hydraulic pump, and the section tested to a pressure of 300 pounds per inch, after which it is packed away with the finished work, for sale, either by itself, a six-horse power boiler, or united with others precisely like it, to form its proportionate part of 600 or other horse power.

Usually the sections are placed vertically on their longest edge, with the front end elevated to about 45°, and if two or more sections are added, they are fixed parallel with the first, with an intervening space of about one inch between the globes. The sections are often made up in different shapes to that described, and set perpendicularly, with equal advantage.

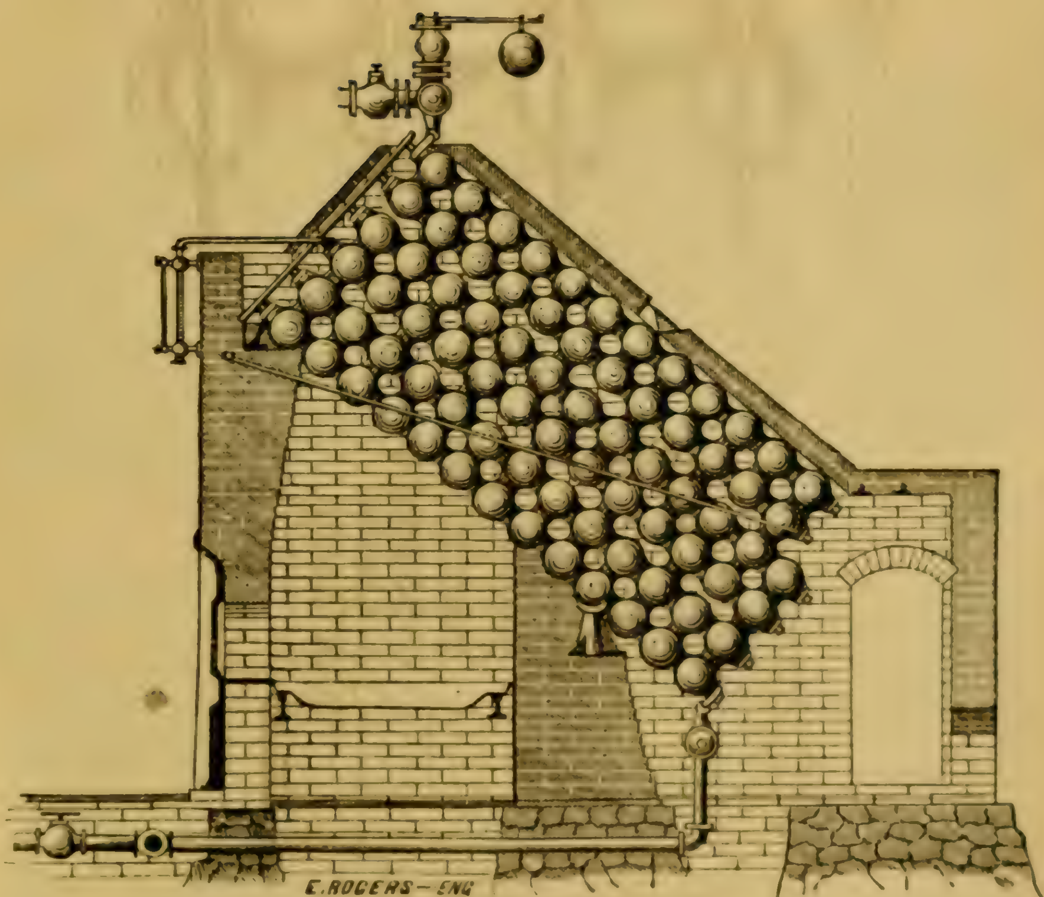
Each pair of sections are connected at top and bottom through their open necks, by curved union pipes, having in the middle a short flanched branch pipe extending outwards from the sections. To the lower branch pipe a transverse feed water pipe is connected, extending across the boiler, and at the top a similar trans-

The Harrison Boiler.





The Harrison Boiler—Side View.



verse pipe for steam is connected, alike common to all sections. The whole being set up in brick work, with proper stay bars and braces, forms a compact and exceedingly neat structure, occupying much less space than ordinary boilers of like capacity. By such a combined arrangement it is only necessary to multiply the number of sections to increase the duty of the boiler to whatever extent of power may be required.

A sphere of the Harrison boiler holds about a gallon of water, and an ordinary section, itself a boiler, is composed of seventy-six globes, fifty-eight of which are filled with water, the remainder being for steam.

Facility for Enlargement and Transportation.

The construction admits of the boiler being enlarged at will, from a small to a larger generator of steam, and such addition is made without disturbing the walls or the floor of the building to receive it. It also admits of being combined, according to the capacity or the shape of the place it is to occupy. Dissected, it may be conveyed through any ordinary door or stairway, a facility greatly in its favor; also for its transportation, particularly across country and over hills and mountains remote from water or railroad facilities of travel.

Strength of the Spheres.

These globes are capable of sustaining a steam pressure of more than 1,000 pounds per square inch. Mr. Zerah Colburn, then editor of that sterling journal of practical science "The Engineer," published in London, and now editor there of another celebrated scientific journal, "Engineering," in a treatise on steam boilers, read before the British Association for the Advancement of Science, in speaking of this boiler, said: "The bursting strength of these spheres corresponds to a pressure of upwards of 1,500 pounds per square inch, as verified by repeated experiments, being therefore from six to seven times greater than that of ordinary Lancashire boilers of large size."*

It will be seen that each sphere is a boiler in itself, of great

* Mr. Harrison being in England in 1864, had some boilers made there upon this system, chiefly to test its practicability. The arrangement of the spheres has been greatly modified and improved since his establishment in Philadelphia or works specially for the construction of this boiler. Mr. Colburn, whom I shall have several occasions to quote in this paper, fully investigated this boiler and its operations, and regarded it as a complete success.

strength against internal pressure; and it is clear that a multiplicity of such spheres can maintain this unit of strength; hence, it follows that a steam generator on this system may be increased to any extent, without weakening the whole or any part of it.

Over 150,000 of such globes have been put in practical use of which number a proportion equal to one in 5,000 have cracked, from all causes, which, considering that it embraces the life of the enterprise, with inexperienced parties and hazardous tests, should be regarded as almost *nil*.

Security of the Joints.

To compensate for irregular expansion under heat, and prevent binding or disturbance of the parts, the transverse steam and water pipes described, are composed of short pieces with spherical joints, and screwed together with tie bolts, as with the units.

If the heat acted *alike* on the cast iron spheres and the wrought iron tie rod, the latter, expanding the most, would tend to slightly separate the joints, but this difference is usually compensated by the globes being at a higher temperature than the rod, so that the joints are kept close. It sometimes occurs that a joint may show a leak for a few minutes when the pressure is low, particularly after a higher pressure, but it will close as the steam rises, from the expanding of the spheres by increased heat.

Those leaks, however, are of no appreciable detriment to the duty of the boiler, as they rarely exceed the amount lost by the ordinary escape from a safety valve. Indeed the joints of this boiler may be all made safety valves, due in a chief degree to the tension placed on the tie rods by the fastening nut, and to the pressure of the steam.

I recently inspected a Harrison boiler of 266 horse power, at the sugar refinery of Messrs. Newhall, Borie & Co., in Philadelphia, which, for more than a year past, has been subjected to most severe usage, carrying 80 pounds and upwards of steam, and so fired for the duty required of it, that the furnace looked more like one for smelting iron, than for a steam boiler—the bricks béing vitrified and run down like stalactites, and yet there was not the slightest leak of water or steam. Yet this boiler contains nearly 4,000 joints. This firm has ordered an additional Harrison boiler of 100 horse power, to be put up in the same works in May next.

Circulation of Heat.

In this condition we have a series of spheres combined for the evaporation of water, and so made up as to admit of an unprecedented proportionate area of grate bars and furnace, as well as a corresponding increase of capacity for the circulation and mixing of the products of combustion, which, in their transit to the chimney, gyrate among and envelop all the globes; each of which being a steam generator, holding only a gallon of water, presents its entire exterior of 198 square inches to the heat; or about 50 inches to each quart of water. Indeed, so complete is the combustion, and so thorough the absorption of heat, that but 350° are often found in the flue of the chimney.

Circulation of Water.

A peculiarity that should not be overlooked is, that the heat first impinges against this boiler, as usually arranged, nearly at the top of the water line, instead of at or near the bottom, as with ordinary boilers; and from that line it sweeps through the group upwards, and then turns downwards to the bottom of the boiler, which takes the last and most exhausted temperature where the water is coldest.

This would at first seem to impede proper circulation, as it readily brings to mind the operation when a test tube and lamp are skilfully manipulated. If the lamp is held to heat the bottom end of the tube, the fluid will be violently projected from the vessel and lost; but when the heat is made to act at a point near the top of the fluid, ebulition will proceed satisfactorily, but there will be no perceptible circulation.

Circulation in this boiler, however, is effected by the steam rising from the lower globes to the higher, each ascending series of globes being further removed from the seat of the greatest heat. The upper globes are not reached until the heat has traversed the width of the section in a diagonal line, and the water, being at a lower temperature in the higher than in the lower series of globes, it rushes down, around, and into the spheres which are sending out the largest volume of steam. A circulation common to each strata of globes, according to its measure of comparative heat, thus insuring constant and uniform circulation, rarely, if ever equaled in contracted water spaces.

As a Marine Boiler.

The position for setting the boiler as described has been adopted for stationary boilers, as affording an easy method for making up uniformly, and uniting the sections; as well as for conveniently securing a spacious furnace chamber, the roof of which, or lower series of globes, thereby having a proper elevation above the fire grate. But for *marine uses* a trial boiler has been set up, with the sections vertical. In this case the lengths across the furnace end forward of the bridge wall are each successively made one globe shorter at the bottom, from back to front. This effects a similar relative position to the grate bars with this arrangement as with the former case; the boiler being enveloped in a double jacket of plate iron, with an intervening air space. The trials with this boiler have been entirely satisfactory.

As a Radiator.

The same system of spheres, similarly combined, are also used as radiators of heat for either steam or hot water. In these cases the globes are cast three-sixteenths of an inch in thickness. A boiler of thirteen spheres, representing one horse power, will supply 100 radiating globes, capable of warming 20,000 cubic feet of space, and so on in that proportion. The boiler is, however, adapted to any form of radiator.

Superheating.

The boiler is its own superheater, without the necessity of any additional or intervening apparatus; and is found more free from priming than other boilers with like conditions of water. Guard or shield plates of cast iron inserted horizontally between the sections, below the water line, deflect the heat from the steam spheres, and regulate or avert superheating.

Comparative Description with Boilers of Wrought Iron.

It is not easy to fully describe the distinctive features of this boiler without referring comparatively to those of wrought iron.

Cast iron absorbs and transmits heat more rapidly than wrought iron, and, in the absence of free oxygen, it is improved under the prolonged moderate heat. But wrought iron, under like treatment, depreciates in strength.

This assertion may be skeptically received by many experienced in treating iron. It can, however, be easily tried. There are cer-

tain analogous facts, well known as resulting from treating wrought and cast iron under similar conditions, where intense heat is present, for instance.

In the manufacture of cast steel, by common process, the best wrought iron is chosen, and hence the softest. This, cut into small pieces, is placed in a muffled crucible, with wood charcoal, and the whole exposed for several hours, subject to intense heat in a furnace, until, by the absorption of carbon, as carbonic oxide, or some unknown condition, the iron is carburetted and poured into ingots of cast steel.

For the manufacture malleable iron, the hardest cast iron is employed. In this process the objects to be treated are packed in iron cases with pulverized charcoal, and then subjected to high heat, in a furnace, for a protracted period, and when withdrawn, is found not only decarburetted, but more ductile than the best quality of wrought iron.

It is reasonable to believe, therefore, that also, under moderate temperature, in the absence of free oxygen, wrought iron, exposed to the gases of carbon, will absorb that carburetting property, in a measure due to the intensity of the heat and its own purity or standard of affinity.

And, conversely, that under like treatment cast iron has the property of parting with a portion of its carbon, proportionate to the measure of the calorific force to expel it. Indeed, so little is really known of the rationale of the phenomena attending those combinations that, both in science and practice, we are compelled to reason rather from coincident results than by known positive causes.

External Deposit.

The spaces between the tubes of wrought iron boilers are not only subject to deposit from the water, and generally inaccessible, but their interior or heating surfaces are always greatly impoverished from an accumulation of those non-conductors, ashes and soot, which are usually removable only when the fires have been drawn. Besides, under the most favorable circumstances, boiler tubes serve as heat conductors but a short distance from the furnace end, beyond which point they serve simply as conduits of the non-heating gases and smoke.

The first products of combustion, the undecomposed gases, are carried into the tubes from the furnace, beyond the reach of oxygen, and are swept off by the draught to waste through the chimney,

while the smoke, being too great a burden for the throttled flue of the tubes, is precipitated there and left; a small proportion of the heating gases entering the tubes is exhausted in the first three or four feet of their length.

The cast iron spheres of this boiler are less liable to deposits of ash, and rarely so of soot. The furnace being proportionately much broader and larger than that of other boilers of like capacity, the circulating flues are spacious and more extensive, admitting air freely, and ensuring almost perfect combustion of the gases, which heat, in its transit to the chimney, envelopes each and all the globes of the boiler. All external deposit is readily removed by the steam brush used through the peep holes at any time while the boiler is at work.

Internal Deposit.

Salt and other mineral matters held in water are, when precipitated, less subject to adhesion in cast iron than wrought. All persons having had experience with the cast iron heads of wrought iron boilers can verify this fact.

Mr. Colburn says of cast iron spheres in this boiler: "Although the spheres may be temporarily coated internally with scale, they are found to part with this whenever they are emptied of water. *This fact is the most striking discovery that has been made in boiler making;* it removes a fatal defect in small water spaces, which can now be used with certainty of their remaining clear of deposit."

This, I think, may be accounted for. The process of precipitation of mineral matters in all boilers being from like causes the same. Those foreign properties in the water concentrate and precipitate from its evaporation, and particularly being more soluble in hot than cold water, settle on the slightest depression of the temperature, and the lower the heat the greater the deposit. The heat being again increased, the stratum is indurated, and once this germ of evil is formed in wrought iron boilers, adhesion being fixed, accumulation goes on rapidly, increasing the danger from day to day.

With the cast-iron globes this action is the same as with wrought-iron boilers, but the scale not adhering to cast-iron as to wrought. When the globes are next heated after the scale is formed, the sphere, expanding in all directions, however slightly, parts from the indurated shell, admitting an infinite film of water between the shell and the iron; the water then bursting into steam

severs the frail post into fragments, which now settle to the bottom. The deposit of another day falls upon and among this ruin, another breaking up from like cause occurs, the process continuing until the blow-off cock is opened, say once a week, after the fires are drawn, with full pressure; when the whole deposit will be ejected, leaving the globes always entirely clear and clean.

I have seen specimens of this deposit from water holding lime, silica, iron and salt, one piece nearly as large as a hen's egg. It was composed of fragments of scale about one-quarter inch square and one-sixteenth inch thick, all concreted like volcanic breccia. In this case the water was very bad, and the attendant had neglected to blow off on the regular day.

With a cylinder boiler such a breaking up can rarely if ever occur. The scale in that case finds a medium of adhesion or cementation in the protoxidized surface of the plate, to which it thereby became a fixed enamel. The increased diameter of the boiler, the enlarged surface of the scale, with its greater adhesion to the plates, all aid to keep it *in situ*. When the plates expand from heat, there being a slight elasticity in the scale, permitting it to yield with the bending iron; it holds fast to its seat, increasing in thickness until dissolved out, or removed by hand, an inconvenient if not a pernicious process, as doubtless the plates of many boilers have been crystalized by the hammering necessary to remove scale.

Durability.

Mr. Colburn further says: "I can but call attention to that great source of boiler casualties, *corrosion*, which has been compared to that fearfully fatal disease, consumption in human life, except that in the boiler it is external as well as internal, and the better or purer the iron the more rapid the corrosion; whereas, iron containing carbon, and particularly silica, is less destructible under like circumstances."

And he further says: "Since superheated steam began to be generally employed, much difficulty has been experienced from rapid corrosion of the superheaters, until Messrs. Richardson of Hartepool adopted cast iron, and this material shows no corrosion at all after four years' use. Cast iron bridges are indestructible by rusting, while large quantities of rust scales are being removed annually from all wrought-iron bridges, the Conway and the Britania Tubulars in particular."

Oxygen in water, as well as that of acids held in water, combining with wrought-iron forms a protoxide which is porous and absorbing, admitting water through it to constantly act on the iron until it is wholly destroyed, whereas the same action upon cast-iron forms a peroxide or a different combination with oxygen, the scale or film of which is impervious to an addition of oxygen; hence it becomes a protection to the metal against further action. Cast-iron cooking utensils of many years' use attest this fact.

I have seen an ordinary cast-iron tea-kettle for family use, which presented no visible depreciation for efficiency after an uninterrupted use of thirty-seven years.

The officers of the Manchester (England) Boiler Association reported in 1862, that with an average of 1,400 boilers under their care, 83 were positively dangerous, 37 dangerous, 987 with objectionable defects, and 270 objectionable from corrosion alone.

Safety from Destructive Explosion.

In the three systems of steam boilers in common use we have first the horizontal, with and without return flues, second the horizontal tubular, and third the vertical, which usually is also tubular.

In each case increased power necessitates increased diameters or length of boiler, or both, and this in turn requires a proportionate increase in the requisite quantity of water the boiler is to hold, which involves as, compared with a boiler of less dimensions, not only greater liability to rupture, but a destructive power of still greater ratio.

Mr. Colburn states, "The danger attending the presence of a large quantity of heated water in the boiler is now well understood, the boiler is weakened in proportion to its increase of diameter, the bursting pressure to a given thickness of plates, being inversely as the square of the diameter, so that in a boiler of given length the elements of weakness and destruction are collectively relative to that of the diameter."

It is now well known that the water in a steam boiler is charged with steam, the pressure of which is equal to that of the steam above it, and of a volume equal to the bulk of water.

It is from this cause that, in the rupture of an ordinary steam boiler, a volume of steam equal to the whole contents of the boiler is instantly liberated, and with it the water, slightly, if at all, obstructed in its wave, is projected with such velocity and force

as to produce an effect upon objects intervening its course, almost, or quite, as great as would be from the projection of a solid body. Therefore, the larger the boiler the more disastrous the effect, this being as the cubical contents of the boiler multiplied by the pressure.

With the greatest care and skill in constructing wrought-iron boilers, there are many features of weakness which must unavoidably occur. We have first the unseen defectibilities of the plates, the liability to strain the iron in bending it cold, the impossibility to punch the rivet holes so as to correspond, and have the rivets always perpendicular to the plate, the necessary resort to the drift pin, and strain in drawing the work together, the constant use of the caulking tool to conceal defects, are some of the facts well known to boiler makers. How often do we read of a boiler exploding when first placed under steam, and the cause beyond the reach of investigation?

The usual cold water test of a new boiler under high pressure often induces injurious strains that afterward develop themselves, while it affords no sign of security from unequal or irregular expansion under heat, either of which may end in its destruction. Such features of danger are beyond the reach of inspection of officials or experts.

An eminent writer says: "Steam boilers are not merely tanks for boiling water, but great magazines in which tremendous power is stored, the safe custody of which is of paramount interest to all in the vicinity." And again: "The strength of any structure is its weakest point."

If the damage was confined to the boiler it would be of little account to the public; but with wrought-iron boilers it is rarely unattended with other injuries—walls overthrown, timbers and flooring broken, splintered and projected as if crushed by powerful artillery, machinery ruined, and, among the ruins of all, the coals of the furnace frequently complete the catastrophe—but that other chapter—the dead, the scalded, and the maimed—call for the exercise of all talent and effort for averting such horrible calamities.

In an ordinary boiler the heat may be so intense in the furnace as to burn or blister or crack the walls, and this may arise, not from the inability of the metal to transmit the heat, but, doubtless, often from such a rapid generation of steam as to overcome the

weight of the water against the plates, separating it therefrom by a stratum of globules of steam, so rapidly replaced by others that the water is borne up, even to the upper gauge-cock, thus deceiving the attendant. The extreme heat increasing and extending to other parts of the boiler, the steam blowing off and still rising in the gauge, the pump seems doing its duty well. The fire is slackened, furnace doors opened, and safety valve raised to bring down the steam. The plates over the furnace, which may have become nearly or quite red hot, now cool down to water contact, and instantly flashing steam beyond the resistance of plates and rivets, away goes the boiler, rattling down everything around it.

Boiler explosions, and severe ones, are not rare in the works of makers themselves, a great disaster of this kind not long since in Philadelphia, and a more recent one in this State, are instances in point. In both those cases the proprietors are eminent for skill and prudential care.

A coroner's jury in Philadelphia, upon the occasion of five deaths from a boiler explosion in that city, after censuring the proprietors of the works, find "The storage of gunpowder in our city is prohibited by law, but any one may place a steam powder magazine, with match burning, at our side or under our feet with impunity; such magazines undermine our crowded streets, and unless properly cared for, will one day reveal their existence in fearful disaster."

A perfect provision against boiler explosions under ordinary circumstances is simply impossible, whatever be the nature of the material of which the boiler is made. The iron or the work may, with the greatest care for perfection, be occasionally weak in some of its parts, or the steam may, from accident or neglect, be increased to a bursting pressure, when all else is right; and such a condition is incidental to a majority of boiler explosions.

It is, therefore, of primary importance that the effects of such accidents should, if possible, be confined to the boiler alone, that no injury shall extend to other property, or the attendants be harmed.

Mr. Colburn, in the paper referred to, says: "Whatever the bursting strength of a riveted wrought-iron cylinder, that of a cast-iron sphere of like dimensions and thickness will be the same."

And, in a paper upon boilers, read before the institution of Mechanical Engineers, at Birmingham, England, May, 1864, he said: "Although it cannot be said that cast-iron in itself, is a

strong material for boilers; yet it will be seen in the form of spheres as now described it affords greater absolute strength against bursting than is possessed by any form of plate iron boiler."

If, therefore, we can employ a group of such cast-iron spheres united, and of a maximum capacity adequate to any standard of duty required, so much of the problem is solved. For it is clear that by such enlargement we will not be compelled to strengthen the whole nor any part of it, for having adequate strength in a single sphere to resist any required pressure, a multiplicity of such spheres, to any extent, may be used with like security.

The fractures that have occurred with the spheres of this boiler have been on the top of a transverse neck of a unit, being simply a crack, in central line, between the globes, and from three to five inches long. From this fissure the steam or water, or both, issue as a film only.

If the contents of the boiler be permitted to escape by the fissure the fires will be extinguished, but if the fires are drawn, the steam relieved and the water blown off, a few hours only are necessary to replace the fractured unit by a new one, and the work of the boiler goes on as usual.

No accident, of any nature, has ever occurred to person or property from any of those boilers, even when fracturing under high pressure. Engineers soon learn that no danger can arise from the boiler, and this has, in some cases, caused too much reliance on its strength, and led to imprudence or neglect. In a case not long since, in this city, a globe was cracked from negligence, under extreme pressure, the engineer volunteering the admission that a similar case with a wrought-iron boiler would have blown the place to atoms.

There are more than 12,000 horse power of these boilers in daily use, varying from 10 to 300 horse power each, and all set up within two years past, yet it is eight years since the invention was practically and satisfactorily tested.

Franklin Institute Experiments.

Some experiments were made during October last, before a committee appointed by the Franklin Institute, for testing this boiler. Their report embraces the following:

First, of a section 78 spheres raised to the position as set up for use, ruptured under cold water pressure in the lowest pair of

globes at 600 pounds, a new pair having been substituted and trial repeated, fracturing again at same place, at 625 pounds pressure.

Second, a similar section set in brick work was filled three-fourths full with cold water and stopped close, except a small pipe leading to a high pressure gauge, the steam was raised to 875 pounds, at which pressure steam and water escaped freely; the gauge depressing gradually rested finally at 300 pounds, and the escape ceased; brisk firing was continued, the steam occasionally escaping, no rupture could be effected. On the section being removed for inspection, it was found that under the intense heat the tie bolts of the lower series of globes had elongated, opening the joints and permitting the escape of the contents until by depressed temperature the contraction of the tie rod closed the seam. The section presented on close inspection no injury, and beyond the necessary slight turning of some of the tie nuts, nothing has been done to this section; as good to-day as before the trial.

Third, similar trial with two sections regularly set in brick work. In this case there being no safety valve, steam, after acquiring a pressure of 125 pounds, was allowed to escape by the blow-off cock, keeping the pressure at 100 pounds, while fireing briskly; after the water got below the lowest gauge cock, a slight leak of steam took place at a joint in the left hand section, but suddenly closed; another leak then appearing in the right hand section, this also closed in a few minutes, no other leak occurring. The water boiled away, the globes above the bridge wall becoming red hot, and yet the gauge indicated 30 pounds from some water in the lower globes. The boiler sustained no injury.

Fourth, a boiler duplicate of the last was charged with water to the upper guage cock, and pressure raised to 90 pounds, blowing off freely, and falling to 60 pounds, where it continued with the blow-off open until the boiler was emptied of water; the fire being kept vigorous for some minutes. The boiler was then rapidly filled with cold water, the stream rising to 100 pounds in thirty minutes, and the boiler was perfectly sound and in no way injured.

The committee further report: "The experiments described were conducted to determine the safety and durability of the boiler, under unusual and severe usage, or rather to determine whether any danger can result from submitting this kind of boiler

to those circumstances which, in ordinary boilers, are thought to result in great injury to the boiler."

The committee are impressed with the great utility of this boiler, as perfectly safe and free from explosion, even when carelessly used. The committee also favorably notice the steam making qualities of this boiler, as also its economy in fuel.

A boiler of the capacity of 80 horse power, for marine purposes, was also tried. In this case the sections were vertical. From cold water the steam raised to thirty pounds in eighteen minutes, to sixty pounds in twenty-two minutes, to one hundred pounds in twenty-six minutes, and to one hundred and fifty pounds in thirty-one minutes. The steam was then run down to one hundred pounds, and the apparatus connected with the main engine actuated the works for the remainder of the day. Pine wood was the fuel employed. The sections were taken indiscriminately from the prepared stock in the works.

The sub-committee for the experiments consisted of the following gentlemen: Coleman Sellers, chairman, John Agnew, John F. Frazer, Henry Morton, J. C. Cresson.

In preparing this paper I have found it difficult to do proper justice to this important improvement, and so condense the matter as not to exceed the proper limit of time for reading it when we consider that the subject involves not only an inroad upon world-wide experience and prejudice, but the complete overthrow of, and substitution for, systems employed wherever stationary steam power is used, and that too by a contrivance not only new but absolutely paradoxical.

Experience with the boiler thus far has established the following features :

Its Absolute Safety from Destructive Explosion.

Its Economy in Fuel.

Its Efficiency as a Steam Generator.

Its Reliability against Corrosion and Sedimentary Scale.

Its Convenience in Transportation.

Its Facility for Enlargement and Repairs.

And if the invention by prolonged use maintains the reputation it has thus far acquired—and there is no known reason to doubt it—I venture the prediction that the days of plate iron boilers, at least for stationary uses, are numbered.

Mr. Harrison, in his admirable "Essay on Steam Boilers," from

which I have made several quotations, concludes with the following paragraphs, which I consider appropriate to this paper:

"The Harrison Boiler has met with more favor at the hands of the public than could have been expected, considering the novelty of its material and form, and the prejudice that so naturally attaches to any effort aiming at an almost entire overthrow of a long established system. Its peculiarities invite criticism, and it would not appear strange if even many of those best acquainted with the subject generally, should pass this by with little attention, thinking at a glance, that it was so much out of the beaten track, as to seem utterly impracticable."

"Nothing in connection with the use of steam has been so much discussed, as the manner of making the apparatus for its generation, and to have called out, for a century past, such an army of thinkers on a subject having in the abstract but a few simple elements, there must have been, and no doubt still is, some inherent defect in the plans heretofore and now used. The field is evidently not yet exhausted, if we consider that in the United States alone, forty nine patents were issued in 1865, and fifty-eight in 1866, for steam-boiler improvements; the lowest number being nearly double that of any preceding year."

"If, in these pages, I have added to the stock of information tending to make the use of steam less dangerous to life and property, I have attained something. If I have been instrumental in producing a steam-boiler that will take its place permanently, as a means of rendering steam generating apparatus more safe from destructive explosion, I shall have attained something more. If in my effort to improve a much used and much abused object, manifestly demanding improvement, I have only succeeded in proving a fallacy, I shall still have my reward."

Bridge Building.

The discussion on this subject was opened by Mr. Alfred P. Boller, who described, with the aid of diagrams, a plan of a proposed railway viaduct across Cattaraugus creek, in this State. In height this bridge would exceed the spire of Trinity Church by at least twenty feet, being 300 feet high.

Mr. Dudley Blanchard gave an interesting dissertation on bridge building, which cannot be understood without diagrams. He proved himself well acquainted with the subject, and made some practical suggestions of value to bridge builders.

After which, the association adjourned.

American Institute Polytechnic Association,
March 21, 1867.

Prof. S. D. Tillman in the chair; T. D. Stetson, Esq., Sec'y.

The chairman opened the proceedings with the following scientific memoranda:

The Fenian Fire.

This modern "Greek fire" consists of phosphorus dissolved in bisulphate of carbon, the vapor of which, when mixed with air and ignited, inflames so rapidly as to cause slight explosions. The compound is not new, an enterprising Yankee having made shells containing this liquid, with which he proposed to defend the American flag during the late rebellion.

The Hoxodrograph.

This is a new apparatus, invented by M. Carrodi, of France, for tracing a ship's course. By means of wheel work inside the binnacle, a long strip of photographic paper is unrolled horizontally with a given velocity. The card of the compass is pierced at the point usually marked "North Pole." In the hole is placed a small object glass, through which light passes, and on striking the moving photographic paper, the actinic impression is made in the form of a line, which varies in direction precisely with that of the vessel, thus furnishing a daily diagram of the ship's course.

New Hydrocarbons.

When cannel coal is distilled, and the product is treated with acid, the oils belonging to the marsh gas and benzol series are separated, and a black, tarry mass remains. From this mass a brown liquid, having an offensive smell, may be distilled at a temperature between 300° and 400°. Schorlemmer, by repeatedly distilling this liquid with caustic alkali and with sodium, has obtained a new series of hydrocarbons, which differ from the homologues of olefiant gas by the addition of two atoms of carbon. Taking the weight of an atom of carbon at 12 and hydrogen at one, the new bodies are represented by $C_{12}\ H_{20}$; $C_{14}\ H_{24}$; $C_{16}\ H_{28}$. The old nomenclature provides no names for these compounds. Their components are expressed respectively by *yerleil*, *yorleul* and *yearloil*.

Substitute for Tobacco.

Dried artichoke has been recommended to those who wish to give up the use of tobacco. The substitute is said to be pleasant to the taste, and entirely harmless. This plant must not be confounded

with the Jerusalem artichoke, a species of sunflower having tubers like potatoes—the word Jerusalem being a corruption of the Italian *girasole*, meaning sunflower. In this country the artichoke proper has been cultivated to a very limited extent, but in Europe, particularly in the southern part of it, the plant is very generally in use. It resembles a thistle, and has large, scaly heads, like the cone of the pine tree ; the fleshy base of these scales, which is the receptacle of the flower, is the most palatable part of the plant.

Absorption of Hydrogen by Copper.

It is well known that a definite but very unstable compound may be formed, containing two atoms of copper to one of hydrogen, by heating a mixture of sulphate of copper with hypophosphorous acid. This compound cannot be formed by the direct action of the two elements upon each other, but M. Caron has lately shown that hydrogen gas may be imprisoned in the melted copper. A small bar of copper was put into a porcelain crucible, introduced into a tube of the same material, raised to a temperature somewhat higher than that at which copper fuses, while a current of hydrogen gas was driven through it. At the end of the tube by which the gas made its exit, a glass balloon, with two wide tablatures, was placed to enable the observer to see what was going on within the apparatus. So long as the metal remained in a solid state nothing occurred. But the moment it began to melt numerous bubbles rose on its surface, and a considerable quantity of steam was condensed in the balloon. This M. Caron explains by supposing that even the best copper contains a little oxide, and that during its fusion the oxygen is expelled, and combining with hydrogen, forms water. After the operation, the ingot of copper was examined, and found to contain numerous cavities filled with hydrogen gas ; whence it may be concluded that copper, in a state of fusion, absorbs hydrogen.

Colors from Artificial Light.

Prof. Nickles, of France, makes, in *Silliman's Journal*, some interesting observations regarding colors, to which he was led by first noticing that a certain chemical compound, known to be green by daylight, was, in the evening, black. He substituted for his gaslight an oil lamp, and afterward a wax candle, but the compound still appeared black. Under the flame of magnesium, however, the green color reappeared, showing that burning magne-

sium acts in this respect like the sun. Blue predominates in this flame, which is really whiter than sunlight. Sodium burns with a yellow (monochromatic) flame, and all colors are altered under this light, with the exception of blue-violet, which is compliment-ary to the yellow. This flame may be obtained by burning chlo-ride of sodium (common salt) supported by platinum, in the flame of a Bunsen lamp, or by burning alcohol saturated with salt. He made a spectrum, by applying pigments to white paper, and found the monochromatic flames produced the following changes of color. Red ochre—sesquioxide of iron—became black. Orange iodide of mercury and yellow chromate of lead, both appeared white; while manganate of baryta and aniline blue were both black. The flame of magnesium instantly restored the normal colors, even while the sodium flame was burning in the neighborhood. Minute quantities of sodium, existing in all ordinary flames, are derived from mineral matters in the wicks of lamps and candles, and the ashes of fuel. Traces of it have been detected in atmospheric air by Bunsen. The effect of a small quantity of this metal in com-mon flames is to alter in degree the color of objects; darkening some and enlivening others, and creating confusion between green and blue. The phenomena of the soda flame explain physiologi-cal effects heretofore unaccounted for. In the flame of alcohol and salt the hands and face appear a livid green, while the lips change to a violet-blue. The livid tint seen in burning punch or pudding is due to the alcohol, more or less saline, which is employed in these mixtures. Workmen at furnaces and forges are familiar with these peculiar tints appearing upon the features illuminated by their fires, which arise from the soda contained in the dross and ashes of combustible matters. The question arises why the natural flesh color is changed to a bluish or livid green? The colors which best resist the extinctive effect of the soda flame come from blue; the latter is the color of the human blood, as seen in the large veins through the skin of the hand; the other colors of the flesh having disappeared, the predominant yellow of the sodium mingles with the blue, and makes a green, which varies in shade from yellowish to bluish, according to the inten-sity of the blue, and producing a most sinister aspect on the human countenance. M. Nickles further states that one cannot work for any length of time in this yellow light without finding the retina of the eye seriously affected.

ICEBERGS.

Dr. Hayes, the Arctic explorer, in his work published by Hurd & Houghton, gives a graphic description of the progress of northern glaciers toward the sea, which, when fairly launched, are designated as icebergs. A block of fresh water ice floating on sea-water rises above the surface to the extent of one-eighth of its bulk and weight, while seven-eighths of it are below the surface. The cause of this is too well known to need more than a passing explanation. Every school-boy is aware that water, in the act of freezing, expands, and that in the crystal condition fresh water occupies about one-tenth more space than when in a fluid state; and hence, when ice floats in the fresh water from which it was formed, one-tenth of it is exposed above, while the remaining nine-tenths are beneath the surface. When this same fresh water ice (which it will be remembered is the composition of the glacier) is thrown into the sea, the proportion of that above to that below being changed from one and nine to one and seven, is due to the greater density of the sea water, caused by the salt which it holds in solution. Now, it will be obvious that, as the glacier continues to press further and further into the sea, the natural equilibrium of the ice must ultimately become disturbed—that is, the end of the glacier is forced further down into the water than it would be were it free from restraint, and at liberty to float according to the properties acquired by congelation. The moment that more than seven-eighths of its front are below the water line the glacier will, like an apple pressed down by the hand in a pail of water, have a tendency to rise until it assumes its natural equilibrium. Now it will be remembered that the glacier is a long stream of ice, many miles in extent, and although the end may have this tendency to rise, yet it is, for a time, held down firmly by the continuity of the whole mass. At length, however, as the end of the glacier buries itself more and more in the water, the tendency to rise becomes stronger and stronger, and finally the force thus generated is sufficient to break off a fragment, which, once free, is buoyed up to the level that is natural to it. This fragment may be a solid cube half a mile through, or even of much greater dimensions. The disruption is attended with a great disturbance of the waters, and with violent sounds, which may be heard for many miles; but, floating now free in the water, the oscillations which the sudden change imparted to it gradually

subside; and, after acquiring its natural equilibrium, the crystal mass drifts slowly out to sea with the current, and is called an iceberg. And thus the glacier has fulfilled its part in the great law of circulation and change.

The chairman presented the report by C. F. Chandler, Ph. D., Professor of Analytical and Applied Chemistry School of Mines, Columbia College, New York, on the

Saratoga Seltzer Spring.

Situation.

The village of Saratoga, in Saratoga county, New York, is built on both sides of a valley which runs nearly north and south. In this valley occur the mineral springs which have made Saratoga the most popular watering place in this country.

At the northern end of the village the valley is quite narrow, and is bounded on the west by a ledge of limestone, the "calciferous sand-rock" of the New York geologists, which rises abruptly thirty or forty feet above the bed of the valley, which is here quite level. At the base of this ledge occur four mineral springs, the Saratoga Seltzer, the High Rock, the Star, and the Empire. The Seltzer lies nearest the village, being seventy-five feet south of the High Rock. The lot on which the spring is situated adjoins the property of the High Rock spring, and extends from Putnam to Front street, a distance of two hundred feet, with a frontage of fifty feet on each street. About three-fifths of the lot is in the bed of the valley, on the level of Putnam street, while the remaining two-fifths are on the limestone ledge, on the level of Front street. The spring is situated near the centre of the lot.

History.

This spring was noticed many years ago, before the valley was drained, and a barrel was sunk into the ground to serve as a reservoir for it, which led to its being called the "barrel spring." Owing to the wet and miry character of the ground about it, it was not much visited, and was in time suffered to lose itself in the swamp, the barrel becoming completely submerged.

In 1860, the lot on which the spring is situated was purchased by Dr. J. P. Haskins, who, in November, 1865, commenced excavating, to tube the spring down to the rock, employing a force of about thirty men. Two months and a half were occupied in excavating a shaft twenty feet long by thirty feet wide, down to the

surface of the rock, a distance of thirty-four feet. The first five feet consisted of muck, the original soil of the swamp. Then came four feet of tufa, a hard, stony mass, which extended for a considerable distance around the spring. This must have been formed from the spring water itself by the separation of a portion of the carbonate of lime, which it originally held in solution.

The following are the results of its analysis:

Carbonate of lime	87.83
Carbonate of magnesia	1.76
Oxide of iron	1.71
Silica (soluble)	0.16
Alumina	3.38
Sand and clay (insoluble)	2.96
Sulphate of lime	trace.
Organic matter	1.09
Water	0.50
Not determined	0.61
	100.

The first four constituents were deposited from the water, while the rest were derived from the soil of the swamp. This layer of tufa is more or less open and porous, with numerous cavities, in some of which small stalactitic masses of nearly pure white carbonate of lime occurred. Leaves and twigs of trees, nuts, &c., were occasionally seen in this bed.

Below this tufa came a layer, twenty one feet thick, of blue clay: then four feet of hard pan; and finally, at a depth of thirty-four feet, the limestone rock.

The work of excavation was greatly embarrassed by the abundant flow of water from the spring. Horse power and buckets cleared the pit till a depth of sixteen feet was reached, when it was found necessary to employ a steam-pump of eight-horse power. At a depth of twenty-five feet this was found to be insufficient, and hand pumps were added. The crevice in the limestone, through which the spring rises, is about twelve inches by five, and seems to be quite vertical, as an iron rod could be pushed down to a depth of fourteen feet. Over this crevice was placed an inverted hopper of wood, six feet square at the rim, and five feet high, well fitted to the surface of the rock around the crevice, and tamped with clay to exclude surface-water and prevent leak-

age. The hopper tapered to a wooden tube, twelve inches square and twenty-nine feet long, which raised the water to the surface of the ground, where it was terminated by a glass tube, three feet high. The column of water above the rock is thus thirty-seven feet high. The water flows over the rim of the glass tube, though the pressure of the column of water reduces the quantity far below what escaped at the bottom of the excavation. The flow of gas is abundant and constant; but every few minutes there is a momentary evolution of an extraordinary quantity, which causes the water in the tube to boil over the rim.

The appearance of this fountain, on a bright sunny day, is most beautiful; the bubbles of carbonic acid gas, as they rise through the water, appearing like struggling globules of mercury.

Geology.

Beginning with the uppermost, the rocks of Saratoga county are: 1. The Hudson river and Utica shales and slates. 2. The Trenton limestone. 3. The calciferous sand-rock, which is a silicious limestone. 4. The Potsdam sandstone; and 5. The Laurentian formation of unknown thickness. The northern half of the county is occupied by the elevated ranges of Laurentian rocks; flanking these occur the Potsdam, calciferous, and Trenton beds, which appear in succession in parallel bands through the central part of the country. These are covered in the southern half of the county by the Utica and Hudson river slates and shales.

The Laurentian rocks, consisting of highly crystalline gneiss, granite, and syenite, are almost impervious, while the overlying Potsdam sandstone is very porous, and capable of holding large quantities of water. In this rock the mineral springs of Saratoga probably have their origin. The surface waters of the Laurentian hills, flowing down over the exposed edges of the Potsdam beds, penetrate the porous sandstones, become saturated with mineral matter, partly derived, perhaps, from the limestones above, and are forced to the surface at a lower level by hydrostatic-pressure. The valley in which the springs all occur indicates the line of a fault or fracture in the rocky crust, the strata on the west side of which are hundreds of feet above the corresponding strata on the east.

The mineral waters probably underlie the southern half of the entire county, many hundred feet below the surface; the accident of the fault determining their appearance as springs in the valley

of Saratoga Springs, where, by virtue of the greater elevation of their distant source, they reach the surface through crevices in the rocks produced by the fracture.

Quantity of Water.

Owing to leakage about the upper end of the wooden tube, particularly where the glass tube is joined to it, it was not possible to determine the quantity of water issuing from the spring. It is the general opinion, however, among those who are familiar with the springs, that the flow if equal, and probably much superior to that of any other spring at Saratoga.

The flow at the brim of the tube has been estimated at two hundred gallons per minute, but I think this estimate much too high, at least while the overflow is maintained at the present level, though it may have been a low estimate for the flow at the level of the rock.

The flow of water is, however, far more than sufficient to supply all that can be bottled; and, should it ever prove insufficient, it can be readily increased by lowering the level of the overflow so as to diminish the weight of the column of water in the tube.

Character of the Water.

As it flows from the spring the water is clear and sparkling, and is highly charged with gas. Down in the earth, where the water is under pressure, it is overcharged with gas, and the removal of this pressure, as the water comes to the surface; causes, as previously remarked, an escape of the excess. The flow of gas is somewhat intermittent; for, while the escape of bubbles is constant, there occurs every few minutes a burst of gas which causes the water in the tube to boil over. The agitation of the water produced by raising and lowering the grating placed in the tube to receive glasses, &c., accidentally falling into the spring, causes, a few seconds after, an escape of gas in unusual quantity.

The temperature of the water is 50° Fahrenheit. The taste is very agreeable, being acidulous and saline, but much milder than that of any of the other Saratoga springs. Its resemblance in flavor to the celebrated Selters or Seltzer water of Germany, was noticed by all who were acquainted with that water, and it has consequently received the name, SARATOGA SELTZER SPRING, by common consent.

The analysis shows that this resemblance in taste is due to a great similarity in chemical composition. The water for analysis was collected at the spring by myself during the first week in August.

The analysis of the German Seltzer Water was made by Kastner, and reported for one pound of water: for comparison it has been recalculated for one gollon.

In one gallon of 231 cubic inches are contained—

	Saratoga Seltzer. C. F. Chandler.	German Seltzer. Kastner.
Chloride of sodium	234·291 grains.	132·673 grains.
Chloride of potassium	1·335 "	0·469 "
Chloride of lithium	0·562 "	0·003 "
Bromide of sodium	0·630 "	0·001 "
Iodide of sodium	0·031 "	
Fluoride of calcium	trace.	0·012 "
Sulphate of potassa	0·557 "	2·217 "
Bicarbonate of baryta	trace.	
Bicarbonate of strontia	trace.	0·083 "
Bicarbonate of lime	89·869 "	19·288 "
Bicarbonate of magnesia	40·339 "	22·354 "
Bicarbonate of soda	29·428 "	77·295 "
Bicarbonate of iron	1·703 "	0·919 "
Bicarbonate of manganese,		0·027 "
Phosphate of lime	trace.	2·328 "
Alumina	0·374 "	trace.
Silica	2·561 "	1·905 "
Boracic acid	trace.	
Total	401·680 grains.	259·574 grains.
Carbonic acid gas	324·08 cubic in.	228·736 cubic in.

From these analyses it appears that the Saratoga Seltzer contains a few substances not found in the German, and although these substances occur in very small quantities, they undoubtedly add to the value of the water.

In strength, the Saratoga Water is superior to the German, as well as in the quantity of carbonic acid gas.

The peculiarity of the Saratoga Seltzer, in which it differs from all the other Saratoga waters, is, that while it is mild and pleasant, and can be used as a beverage, alone or with wines, as the German Seltzer is used, it contatns a sufficient quantity of mineral matter—

all the substances found in the other Saratoga waters and in the German Seltzer—to make it a most valuable remedial agent.

Its physiological effects have been already tested by numerous persons who have used it during the past year, and it has been proved to possess all the valuable properties which have so justly given the Saratoga waters their world-wide reputation. As a cathartic, diuretic, alterative, tonic, &c., its action is found to be most satisfactory. When properly bottled, the water retains all its agreeable properties indefinitely, and remains perfectly clear and free from sediment.

The following new inventions were exhibited and explained :

New Printing Machine.

Mr. Buell exhibited a new printing machine, intended chiefly to facilitate copying, though it may, however, be used to print circulars, and almost everything used in offices. The type are all arranged in a circle, all meeting in a common centre. They are inked by a ribbon, as in the ordinary die stamp, and are acted upon by a set of keys such as are used in pianos. The operator strikes a key and thereby raises a letter, which prints a character on the paper. The rapidity and accuracy with which this may be done depends solely on the expertness of those using the machine. A great advantage is gained by arranging in the centre of the key board those letters and combinations of letters which most frequently occur. Specimens of the work were handed round, and were much admired by the audience. It was doubted if the machine could print faster than a good penman would write.

Machine for Making Stereotypes.

Mr. Boyd Elliot described a machine somewhat similar, intended to form a matrix for stereotypes, by making impressions in thick soft paper of the letters, words and characters. The work can be done three times as fast as printers can set type. By this process a vast saving of labor can be effected in composing rooms of all printing establishments. Music can be printed perfect and with great rapidity. After the impressions are made on the sheets of thick blotting paper specially prepared, stereotype plates are then cast from the mould or matrix.

New Steam Plough or Spader.

Mr. Willard exhibited a model of his patented steam plough, and operated it on table covered with earth. Its novelty consists in placing, side by side and lengthwise of the machine, a series of bars, which are connected at each end with a crank. Underneath each bar, and firmly attached to it, are several projections, like spades or cultivator teeth, which, as the bar is lowered by its cranks, penetrate the soil and move it in the act of leaving it. This machine has not yet been tried on a large scale. The principal advantage in this implement seems to be that the action of the teeth or spades tends to propel the machine. About eight-tenths of the power of other locomotive ploughs are expended in moving the machine. In this there seemed to be some saving of power required for propulsion.

Mr. Elliot suggested that there was danger of packing the earth too much by the weight of the machine, although the spades succeed the wheels in the model shown. The general opinion expressed was that the plan was worthy of a trial on a large scale.

Chimney Ventilator.

Mr. Horton exhibited an improved chimney ventilator, which seemed to be similar in construction to some now in use; but the inventor claims that his ventilator works equally well in every direction of the wind, and is more simple in construction, and therefore cheaper than ordinary ventilators.

Gold.

Professer R. P. Stevens spoke on the subject of gold, and sought to account for the small quantity in circulation in this country. Of all the gold produced in the United States, 15 per cent. is employed in manufactures; 35 per cent. goes to Europe; 25 per cent. to Cuba and Brazil, and five per cent. to China. A large proportion of that sent out of this country finds its way to the east, where it is lost to commerce. A large quantity is there melted down and used to form ornaments, and not less than thirty per cent. is hidden or buried. The reason why bullion does not remain in civilized society is that men will exchange it for what is to them more valuable. The miner exchanges it for the necessaries of life. In New York gold is twice as valuable as in Nevada, and in India fifteen more so than in the placers. The quantity of gold in the world at the time of the discovery of America by

Columbus, was about $170,000,000. A century later it had increased to $690,000,000. At the commencement of the present century, it was calculated to be $6500,000,000.

The Professor concluded by expressing the opinion that in this country, at least, there will be gold enough for the next thousand years.

Dr. L. Feuchtwanger read the following paper on

Natrona Chemicals.

Natrona is a new and extensive manufacturing place. Its monthly chemical products are as follows:

40,000 pounds of concentrated lye.

250,000 pounds of oil vitriol.

15,000 pounds of aqua fortis.

15,000 pounds hydrocloric acid.

1,200 barrels salt.

100,000 pounds copperas.

4,000 barrels of coal oil are refined there.

100,000 bushels of coal are dug out, besides a large quantity of allum, pure allum cake or sulphate of aluminum, sal soda, bicarbonate of soda, &c.

There are also decomposed 400,000 pounds of cryolite, which require 200,000 pounds of lime per month, for the production of caustics, sal soda, &c.

This place commenced about twenty-five years ago, on account of its saline springs. It is situated on the Alleghany river, twenty-three miles from Pittsburg. The Western or Pittsburg railway passes through the place, and the Alleghany Valley R. R. passes on the other side of the river, and there are employed 1,200 hands for the production of the above named chemicals. Some enterprising Philadelphians embarked in the manufacture of salt, and purchased a few hundred acres where a large deposit of coal is contiguous to the saline spring, which is now about 450 feet in depth. The bittern, or what is called the remaining liquid after the salt has been crystalized out of it, has been treated for bromine, and some years ago I purchased myself 100 lbs. of the latter, while at present there are but 10 lbs. manufactured per day.

The low price of the salt, and the desire of the company to make the alkalies in the same prolific and profitable manner as the English mannfacturers produce them from the salt, incited them to erect large works for that purpose. One of the most important constructions is the oil of vitriol chambers and its concentrating

apparatus, as there was no establishment west of the Alleghany mountains at that time. It is well known that the salt has to be decomposed by the oil of vitriol, in order to obtain a residuum, which is the base of all the varieties of ash. It required a large amount of acid. For instance, 13,000 pounds of salt required 10,000 pounds oil of vitriol to produce 15,000 pounds hydrochloric acid, and the residue is called salt cake or sulphate of soda. The sulphuric acid, as it comes from the chambers, stands at but 48° B. It is too weak for practical use, and requires concentration. It is therefore necessary to perform this operation in a platinum vessel, made like a common still or alembic, of forty gallons capacity. The oil vitriol at first obtained is concentrated in shallow lead pans; on getting stronger, the acid, while warm, will attack the lead, and recourse must be had to glass or platinum retorts, which are placed in an iron envelop. The partially concentrated acid passes through a pipe into a retort, where it boils; then it passes out by a Liebig cooler into a cooling box containing two lead pipes. The weak acid vapors escape through a pipe in the top, and are condensed in another chamber. The acid running out through the last cooling apparatus is 66° B, and out of this still twenty-four carboys per day are obtained. The price of such a still, imported from France, is $15,000 in gold. The uses of oil vitriol are manifold; not only for the conversion of the salt into sulphate, and thereby obtaining hydrochloric acid, but also for the purpose of manufacturing aqua fortis, or nitric acid, by the decomposition of nitrate of soda, or potash; if from soda, salt-cake is likewise obtained, and if from potash, the sulphate of potash is the result, which is used in the manufacture of potash alum.

The company has agents in New York, Philadelphia, Boston and elsewhere, to purchase from other chemical works the salt-cake, paying $10 to $12 per ton, and as much more for freight to its place of destination.

For all these operations the company digs 3,000 bushels of their own coal per day, and produce their concentrated lye, put up in cans, and prepared by calcining 100 pounds of salt-cake with 55 pounds of charcoal and 120 pounds of chalk.

The progressive Yankee spirit, always on the alert for improvements and inventions, has entered into the minds of our Philadelphia friends since hearing that, for some years back, soap factories and chemical works in Paris were supplied with a new material for the production of their alkali, and learning it was the mineral

called cryolite. Its principal locality is at Arksceidford, West Greenland. According to analysis it contains of 54.2 per cent of fluorine, 32.9 per cent of sodium, and 12.9 per cent of aluminum. Finding that in Denmark it was even used by itself in the manufacture of soap, the company resolved to secure one of their number to the locality, and, if possible, to secure the monopoly for the United States from the Danish government. The mission was quite successful. A Danish company, under the government charge, has entered into contract with the American company by which the latter agreed to remove, at its own expense and in its own vessels, not less than 6,000 tons annually, and for which a certain price has to be paid, according to analysis by a chemist who has been sent here in the interest of the Danish company, for the cryolite as dug out is not quite free from other mineral substances. Prof. Shephard has lately described three or four mineral substances which were lately discovered in the cryolite. On my visit to the soda works I saw several piles of cryolite containing not less than 8 or 10,000 tons, brought to our shores in about twenty schooners.

Professor Julius Thomson, of Copenhagen, has established in that city large works for decomposing cryolite by a new patent process, using the various lime compounds, such as chalk, caustic lime, chloride of calcium, and, according to his method, seven other establishments are operating in Germany. The United States company is likewise benefited by this process. The supply of cryolite in Greenland appears to be inexhaustible, and it has been calculated that 100,000 tons deposit can be obtained without entering into the bowels of the earth. The formula of cryolite is $3\ Na\ Fl + Al_2\ Fl_3$. Its hardiness is 2.5 and its specific gravity 2.94. It is fusible into a white enamel even in a candle flame; is perfectly soluble in oil of vitriol, but not so in hydrochloric acid. The object of using cryolite is to obtain from it the amount of the metals which combine with oxygen to form oxides and salts, or, in other words, when cryolite is completely decomposed it yields to the 100 lbs. 24 lbs. of alumina and 44 lbs. of soda (anhydrous), or 76 lbs. of pure carbonate of soda, or 204 lbs. the common crystallized sal-soda. The cryolite is decomposed and manufactured into soda and sulphate of alumina by the following process, either in the wet or dry way: If in the wet way, the finely ground cryolite is boiled with slacked lime, whereby salts of soda and alumina are formed, the insoluble part being a fluoride of calcium; 80 lbs. of

lime are required to decompose 100 of cryolite. The sediment is separated, and the lye, standing 20° B, is treated with carbonated soda-lye and steam; the lime and alumina are separated by carbonate of soda, and pure alumina will settle down.

The dry process consists in calcining 150 lbs. of chalk with 100 lbs. of cryolite, in a peculiarly constructed oven for two hours; whereby, again, the carbonate of soda and alumina with soda and fluoride are the results. The mass is lixiviated by water and steam; a little caustic lye is added for the purpose of getting out all the alumina, which may then be thoroughly separated carbonic acid gas, obtained by the burning of coke in a draught of air brought upon it by the aid of a centrifugal blower.

After some discussion of the points presented in this paper, the association adjourned.

AMERICAN INSTITUTE POLYTECHNIC ASSOCIATION,
March 28th, 1867.

Prof. S. D. Tillman in the Chair; T. D. Stetson, Esq., Sec'y.

The meeting was opened with the following scientific news, presented by the Chairman:

GLASS AS A BUILDING MATERIAL.

The whole amount of glass used in the Paris Exposition building would cover a space of 19½ acres.

ANNUAL PRODUCTION OF DIAMONDS.

The total value of the diamonds yearly found throughout the world, is estimated at $4,400,000.

ELECTRICAL STATE OF THE EARTH'S CRUST.

M. Matteucci has discovered that if the surface of the earth be connected at different altitudes by a conducting wire, a constant current of electricity will flow from the lower to the higher point of contact, the intensity of which will be in proportion to the difference in altitude of the two points. Geological formations and atmospheric changes will, of course, modify this action.

IMMENSE MACHINES.

Mr. Krupp, the proprietor of the celebrated steel works at Essen, Prussia, is now engaged in constructing a plate mill, which

will contain two rolls for pressing iron, each over twenty-seven feet long and five feet in diameter, weighing over one hundred tons. In this mill he proposes to produce a steel plate of sufficient size to make the complete shell of an ordinary sized boiler for a steam engine. He is also constructing a steam hammer which will weigh 240,000 pounds.

Snow in 1867.

The *Detroit Post* calculates that during one month of the past winter 1,410,000,000 tons of snow fell in the United States. Some idea of this vast weight may be had from the statement that it is more than ten times the weight of all the wheat grown in this country since its first settlement. Since this estimate was made very large quantities of snow have fallen; enough to place the winter of 1867 at the head of snowy seasons.

A Curious Quadruped.

A small ruminating quadruped from intertropical West Africa, known as the *Hyomoschus aquaticus*, has been brought to the Geological Gardens, London. In external appearance it resembles the *Meminna indica* or "mouse deer" of India and Ceylon. The *Hyomoschus* is very remarkable for being the only known existing member of the order *Ruminantia*, in which the metacarpal bones are distinct and separate, and not united to form a "cannon bone," while its metatarsals are only partially jointed. Its fore leg is very similar in structure to that of the peccaries among swine, and its alleged aquatic propensity is further suggestive of its affinity with certain genera of that animal. In some respects its structure is like certain fossil animals found in the gypsum deposits near Paris, and it is therefore of considerable interest to Paleontologists.

Supposed Obscuration of a Lunar Crater.

Herr Schmidt, of Athens, reported an obscuration of a volcano in the moon called "Linné" on the Mare Serenitatis during October and November last. Mr. Birt, Secretary of the Lunar Committee of the British Association, states that Schröter, in November, 1788, records a dark spot in the place of the usually bright crater; further, he had examined photographs taken by Mr. Buckingham, of Walworth, during the past two months, and in almost all the place of "Linné" is very faintly marked. Lohu-

man saw it in 1823, more than seven times brighter than the crater Kepler. Beer and Madler's observations in 1821, Warren de la Rue's photographs in 1858 and 1865, and Rutherfurd's photographs, all tend to confirm this statement. *Per contra*, we must report, from this side of the Atlantic that Mr. Rutherfurd has lately examined all his photographs of the moon (which, it is well known, far surpass in size as well as minuteness of detail, any European pictures), with especial reference to this subject, and he avers that he is unable to detect any change in the brightness of Linné.

Saponification.

M. Moriés, of France, has recently proposed a new method of saponification, based on his discovery that neutral fats in the oil seed, during germination, as well as that in the animal organism during life, consist of rapidly moving minute globules which present great surface for the action of reagents. In this state they absorb caustic ley in proportion varying with the temperature; glycerin is given off, and each globule becomes a perfect globule of soap filled with ley, which, when subjected to a temperature of 140° Fah., parts with its ley and retains the water required for ordinary soap. By stirring the mass it is separated into two layers, the upper being melted soap, and the lower ley containing glycerin. It is only necessary to add diluted sulphuric acid to the saponified portion in order to obtain stearic and oleic acids, which are separated from sulphate of soda, thus formed, by means of steam. This process of saponification requires about six hours; and in twenty-four hours a soap is made equal in quality to the best olive oil soap. No loss of fat is incurred, as is the case in the ordinary process. The inventor makes at his factory near Paris, three thousand pounds of fatty acids daily.

Skeleton Leaves.

The following method has been communicated to the Botanical Society of Edinburgh: A solution is made of 30 oz. of washing soda and two pints of boiling water; to this is added 1½ ounces of quicklime, previously slackened; boil for ten minutes; decant the clear solution and bring it to the boiling point. During ebullition add the leaves and continue the boiling for an hour, in the meantime adding water to supply the waste by evaporation. Take out a leaf and put it in a vessel of water, rub it between the fingers under the water. If the epidermis and parenchyma separate easily,

the rest of the leaves may be removed from the solution and treated in the same way; but if not, then the boiling must be continued for some time longer. To bleach the skeletons, mix about a drachm of chloride of lime with a pint of water, adding sufficient acetic acid to liberate the chlorine. Steep the leaves in this about ten minutes, or until they are whitened, taking care not to let them remain too long, otherwise they are apt to become brittle. Let them float on pieces of paper in clean water; remove them from the paper before they are quite dry, and place them in a book or botanical press.

Lime Juice and Scurvy.

The editor of *The London Chemical News*, in drawing attention to a discussion which has been going on for some time respecting the value of lime juice as an antiscorbutic, concurs in the opinion expressed by Baron Liebig, and other high authorities, that the specific in lime juice is actually the potash it contains. Lime juice is used in the English navy and merchant service as an efficient antiscorbutic. Among American seamen scurvy is almost unknown and this immunity has been ascribed to the very general use of potatoes, while in France and Russia the rareness of this disease is ascribed to the almost universal consumption of light wines as a beverage. Rice, which has been frequently proposed as a substitute for potatoes, has, however, been proved to be utterly valueless as an antiscorbutic. Again, the evil effects of salt meat are notorious, but fresh beef alone is capable of preserving health for almost any length of time. Fresh vegetables, as a rule, are rich in potash salts; potatoes, which may be placed at the head, containing from 51 to 55 per cent in their ash. Grape juice which may be considered as the representative of the light wines used in the French and Russian marine, contains in its ash from 60 to 70 per cent of potash. Rice, however, contains only two per cent in its ash; lime and lemon juice about half as much as the potatoes.

Assuming, as will most likely prove to be the case, that the potash salts are the specific agents against scurvy, chemical analysis is seen to be insensible in the selection of antiscorbutics for use on board ship. It then, however, becomes a question whether the active agent could not be stored and administered with far more economy, ease and efficacy in the form of some convenient pharmaceutical preparation (such as the *granulated effervescing citrate*

of potash) than when given through the exceedingly unscientific, clumsy, and oftimes repulsive expedient of serving out lemon juice to the men. It might also be worth while to ascertain whether the desired end could not be secured by letting chloride of potassium partially replace chloride of sodium (common salt) in the preservative process to which the provisions are subjected.

Mr. J. H. Gray exhibited a model, and gave the following description of his ingenious

Mill Stone Dressing Machine.

The purpose of this invention is to assist millers in performing the difficult and laborious task of dressing or picking flour mill stones. The operation of dressing mill stones consists in cutting fine parallel lines in the operative surface of the stones, some millers claiming to make as many as from thirty to forty lines in the space of an inch; even the fine lines made with a diamond have been used for this purpose.

This operation has to be repeated about once a week, and to perform it in the ordinary way is a very difficult and laborious task. In fact, it may be considered a fine art, for none except those who have become skilled by long and patient practice can execute it properly.

Few millers possess the ability to perform this work satisfactorily, and as the quantity and quality of the flour produced depends much on the accurate manner in which the stones are dressed, consequently it is evident that by the old process an immense loss is occasioned by the lack of skill on the part of millers.

By the aid of this machine the work can be executed by an unskillful miller in an easier, quicker and more accurate manner than it is possible for the most skillful with the handpick.

The following difference was found in favor of using the machine over the old process, by a test made at Messrs. Wright & Torr's mill, North Leominster, Mass. A quantity of wheat was weighed and ground with the stones dressed by the old process, and the results noticed. Then the stones were dressed with the machine, after which the same quantity and quality of wheat was ground, the result of which was an increase in the quantity of flour produced, of four and three-tenths per cent. in favor of using this machine.

Samples of the flour were inspected by superior judges, who pronounced that which was produced after using the machine as worth *one dollar* most per barrel.

On this test the machine was worked by an unskilled man, who had never dressed a flour run of stones before, and the time occupied by him was but one-third of that usually taken by a skillful miller.

As the pick is guided by the machine, and as every blow is struck perfectly square and true, consequently the edge of the picks do not crumble, but hold an edge much longer, cutting fine, straight and parallel lines at any distance apart required, and giving a system to the work, which it is impossible to attain by any other means; and as the picks for the machine are inexpensive, compared with hand picks, the saving made in them alone will, in a short time, amount to the cost of the machine.

Attempts have been made to perform this work with machines driven by power, all of which have proved futile.

Owing to the unequal hardness of the stone, and the varied nature of the work, judgment must be exercised in the force given to every blow of the pick, and considering this fact, the inventor believes that a machine, where each blow of the pick is under the complete control of the operator, is the only practical principal on which one can be constructed; and that considering the simplicity, durability, and many advantages derived by the use of this machine, that it merits a general adoption in flour mills throughout the country.

Formation of Icebergs.

Dr. Warren Rowell read the following extract from a review in the *N. Y. Tribune:*

"The central point of the expedition was its arrival at the shore of the Polar sea, in latitude 32° 35′ or about five hundred miles from the North Pole. This took place on the 18th of May, 1861. The observations of Dr. Hayes at the place confirm the statements of Dr. Kane, and furnish us with more precise and accurate ideas concerning a locality of such profound geographical interest. The Polar sea extends about the North Pole of the earth, with an average diameter of more than two thousand miles. It is almost entirely surrounded by land; its shores, for the most part, are well defined; the north coasts of Greenland and Grinnell Land, which projects farther into it, being alone undetermined. To a certain extent, these shores are at a uniform distance from the Pole, and are everywhere within the region of perpetual frost. The long line of coast, interrupted in three principal places,

through which the waters of the Polar sea mingle with the waters of the Atlantic and Pacific oceans,—these breaks being Baffin's bay, Behring's strait, and the broader opening between Greenland and Nova-Zembla. The waters of the Pole are constantly displaced by the waters of the equator, so that the great body of the former is never chilled to within several degrees of the freezing point. Hence the whole region is tempered with a warmth above that which is otherwise natural to it. The surface water only reaches so low a temperature as to freeze. When the wind moves the surface water the particles which have become chilled by contact with the air mingle in the rolling waves with the warm waters beneath, so that ice can only form in sheltered places, or where the water is so shallow that it becomes chilled to the bottom, or where the air over the sea is uniformly calm. As the winds blow as fiercely over the Polar sea as in any other quarter of the world, the Polar ice covers but a small part of the Polar water, being found only where it is nursed and protected by the land. It clings to the coasts of Liberia, hugs the American shore, fills the narrow channels which drain the Polar waters into Baffin's bay, crosses thence to Greenland, from Greenland to Spitzbergen, and from Spitzbergen to Nova-Zembla, investing the Pole with an uninterrupted belt of ice clinging to the land, more or less broken as well in winter as in summer, but with its fragments ever moving to and fro, forming a barrier which has thus far been impenetrable to the arts and energies of man."

Dr. R. then gave his own views as follows :

The water flowing into the Polar sea through Behring's strait is 20° F. warmer at fifty fathoms deep than on the surface (see Com. Rogers' N. W. expedition), it being salter than the surface. No glacier can, according to Dr. Hayes' theory, be pushed into this water, as but twenty feet in thickness is added yearly to this ice belt, and as it takes 100 years to form 2,000 feet in thickness, consequently, the berg, if pushed into the sea by glaciers flowing on the bottom until their bulk was overcome by the gravity of the water, they would melt as fast as they reached the water. The line of perpetual ice is lat. 80°; the Polar sea is 2,000 miles in diameter—making a coast line of ice for the Polar sea of from six to ten thousand miles. The rivers flowing north never pass this ice belt, but flow in fresh water channels, between the coast and ice belt, into the Atlantic ocean. The ice bergs are suspended over the Polar sea till their size and weight and the influence of

of the sun overcomes their hold to the main ice belt, and they fall at once into the sea and make a freshet, which breaks the way through Baffin's bay and East Greenland sea, and they then float out to the Atlantic. The berg must fall into water deep enough to float it. The moment it touches ground its voyage to the Atlantic is over. If there is no fall of ice bergs the channels through the Polar sea do not open for that summer. Capt. Ross had to summer over two years in his second voyage to the Pole, in 1830, because the upper water of Baffin's bay did not open by this iceberg freshet.

Captain Scoresby and other Arctic navigators, speak of seeing five hundred icebergs at one time. Suppose they contain one hundred cubic miles of ice; they would, by their sudden fall, raise the water of the polar sea two feet, and that would make freshet enough to open the channel to the Atlantic. Had we no other data, the phenomena of the icebergs are sufficient to warrant the supposition of an open polar sea. If there was no open polar sea, there could be no icebergs, as the water flowing into Behring's straits would flow along the outer edge of this central glacier, and mingling with the rivers flowing north, would melt the outer edge of this central glacier gradually away, and always keep it within certain limits. In fact, this fresh water flow is the channel in which vessels have sailed along the Arctic coasts.

Icebergs always float in fresh water, as they melt away fast enough to kept themselves in a bath of fresh water at 35° F.

All the Arctic navigators speak of meeting icebergs in their voyages to higher latitudes. Where there is no open passage, of course there are no icebergs, for there was no fall of icebergs to open the passage. The fall of 100 cubic miles of ice would raise the temperature of the polar sea about 5° F. A cubic mile of water weighs one million million pounds.

Towards the south pole icebergs are rarely seen, as there there is a central glacier, and the ice melts away at the outer edge, except occasionally it may overhang enough to make a regular iceberg by falling off.

Ice sinks by being drilled, so to speak, by water at 40° F constantly sinking into numerous holes in the ice. As soon as this water is cooled to 32°, it is displaced by new water at 40°. The ice by this process becomes like a great mass of candle molds. Here is an artificial iceberg, about six inches cubical diameter, made of one-half inch glass tubes six inches long, all of them

closed at one end, and enough closed at both ends to make the thing float. (Dr. R. exhibited a model illustrating his idea.) It will float in water at 40°, but sinks in water at 35° or 45°, especially if the tubes are filled with water at 40°. Should ordinary river ice, in this condition, move, it crumbles to pieces, and then cannot sink; but if it is in still water it readily sinks, especially if the surface has been flowed over by muddy water from spring freshets.

The remarks of Dr. Rowell brought to the floor several gentlemen who advocated the generally accepted theory regarding the glacier origin of icebergs.

Mr. Alfred P. Boller, civil engineer, was then introduced to the audience, and read the following interesting paper:

PROPOSED BRIDGE OVER THE EAST RIVER.

Perhaps the most difficult operation to be met with in the province of civil engineering, is when the engineer is called upon to erect bridges under peculiar requirements across great valleys, estuaries, or broad and rapid water ways; and I may safely say that no task demands greater skill and judgment, both in the character of the bridge to be adopted, or in its after construction. This difficulty has been most thoroughly appreciated by the residents of both New York and Brooklyn, especially during the past winter. The absolute cessation of intercourse between those two cities at different times, caused by ice blockades, has demanded that some method should be adopted that forever and at all times would allow of a permanent and invariable communication. Numberless have been the plans proposed to afford relief, from a tunnel to all kinds and varieties of bridges, most all of which will tumble with their own weight, and fall still-born to the ground. I will not trespass upon your time reviewing all these schemes, proposing to discuss this evening a bridge plan, which I hope will meet with your approbation. The site suggested is the crossing at Rutger's street, where the river is the narrowest, the New York approach starting from Chatham square. In this discussion I shall only treat of the bridge proper, leaving the matter of approaches out of the question, simply because they are dependent upon so many local considerations, as well as necessary to any bridge that should be adopted. The main question is: What is the best system of bridging that can be adopted? To answer this question, we must first settle upon the requirements of the case, and then pass in rapid review the known systems, and see in what way they

either succeed or fail in answering them. We must bear in mind that a bridge at any site must cross a broad river with rapid and variable currents, separating two large cities with concentrated and growing populations, in constant and intimate intercourse with each other, besides bearing upon its surface a vast commerce, which involves in its prosecution myriads of vessels, from the small oyster boat to the stately vessel employed in the China trade. From these considerations, we deduce four leading points to start from. These are: *First*, that the navigation of the river shall not be interfered with, thus determining the height of superstructure above high water. *Second*, that the river channel shall be contracted to a minimum amount, involving the necessity of long spans. *Third*, that property shall be interfered with and destroyed as little as possible in both New York and Brooklyn. *Fourth*, that there must be at least two carriage ways, and two broad footwalks, one on either side. We might add a *fifthly*, the minimum cost that will accomplish these results. That bridge which will satisfactorily answer all these requirements is clearly the one that should be adopted. It is an easy matter to sit down with a sheet of paper before one, and with a few strokes of a pencil jumping the river with a single arch, or perhaps strike off a suspension bridge of fabulous span. I must remind projectors of such Quixotic schemes that there are certain laws that will not be violated in actual practice, however they may be set at defiance upon paper. Do what we will, we cannot change the fixed principles of statics and the equilibrium of forms, nor the physical properties of materials of construction, any more than we can change the four seasons into their opposites. The *engineer* has to use what nature has given him, and can only bend to his service the maximum faculties of the workshop and foundry. So in a measure he is limited at the start by the knowledge of the practical part of his profession, and he has more sense than to retire to his office or study and prepare a design, no matter how correct theoretically, that transgresses what he knows to be feasible.

For the sake of convenience, if you please, we will consider our subject in the following order: *The Tubular Girder; The Trussed Girder; The Suspension Bridge;* and lastly, *The Suspension Trussed Girder.* You will notice in this classification I have left out the arch system altogether, since its want of adaptibility to the crossing of the East river strikes even the unprofessional man at once, and I do not care to enter into a useless discussion.

Tubular Girders.

Noticing the first system, we have before us a magnificent type in the Menai and Conway bridges of Stevenson and Fairbairn. These works are probably well known to you all, as well as the story of their inception and completion. You can recall the vast outlay in brains, time and money required to prove the feasibility of the idea, and although the adaptation of the tubular girder for great spans, and its level roadway, allowing great height, its ugliness and cost, in connection with the advanced state of the science of bridge construction, will allways militate against its use hereafter.

The total length of the Britannia bridge is 1,511 feet, in two spans of 460, and two of 230 feet in the clear. The two tubes (one for each line of rails) employed in their construction nearly 9,500 tons of wrought iron, 1,015 tons of cast iron, and 165 tons of permanent way. These two tubes are composed of 186,000 separate pieces of iron pierced by 7,000,000 holes, and united by over 2,000,000 rivets. They contain 83 miles of angle iron, and their total weight is 10,540 tons. The total cost of the bridge was about $3,000,000, nearly $2,000 per lineal foot. At the present time, in this country, we may safely say that $6,000 per lineal foot would represent the price of its reproduction. From these few figures I think that you will see very clearly that the question of cost puts the further consideration of this system aside. So much for the tubular system.

Trussed Girders.

We now come to *trussed girders*, which are an outgrowth of the problem always presented to the American engineer, and that is to accomplish the greatest results with the least expenditure of time and money, stand in the names of the various patentees, and we have the original "Whipple," the parent of the trussed cast and wrought iron girders, the "Murphy Whipple" and the "Linville Whipple," these two last varying from the parent bridge in details merely. Then again there are the Fink and Bollman trusses, the Lattice girder, and what is known in England as the Warren triangular girder. There are a few others, not so well known. as the "Post" truss, a cross between the triangular and Whipple bridges. The efforts of the designers, in all these trusses, is to use that material which, with the least expense, is best able to resist the particular strain that comes upon it, and to

reduce all the material to a minimum, thus guarding against dead weight, at the same time avoiding all unnecessary expense. The annexed diagram (fig. 1) will illustrate the general arrangement of trussing in the Whipple bridge and in all its modifications. The heavy lines represent cast iron, while the light ones are of wrought iron. The diagonals slope at an angle of forty-five degrees.

As will be noticed, the weights are distributed both ways to the abutments, in an inverse ratio to their lever arms, by means of a series of triangles, the rods proportionally becoming more strained as we approach the ends of the truss, where they hold up the whole weight of bridge and its load. The verticals receive an increasing thrust in the same way. The strains in the horizontal members are the horizontal components of the diagonals, which, in the lower chord are positive or tensile, and in the upper, negative or compressive. These horizontal components are a minimum at the end panels, and increase toward the center where they are a maximum. This increase is measured by the summation of the horizontal components at every panel. This, in general terms, is the distribution of weights in a truss of this description, with the strains they engender, which strains you perceive are very readily calculated. I would, if I had time, show you the arrangement of parts, but as much remains to be said, I will now turn to the "Fink" and "Bollman" trusses, of which the skeleton diagrams below will show the general arrangement of parts. In both the weight is transmitted by means of tension rods of varying length, carrying it at once to the abutments, and in doing so give a uniform strain throughout the top chord.

In the Fink truss (fig. 2) the tension bars of *each system* being all of the same length, and each system of supports comprising either one-half of the next larger or embracing two of the next smallest systems, the mode of action of the truss, as also the computation of the strains becomes a matter of great simplicity. You see that each post bears a weight proportional to its covering system, so that the middle post bears one-half the weight of one truss, the quarter posts one-quarter, and so on. The tension rods are strained proportionally to their inclination, and in very long spans, unless the truss is extremely deep, they lie at a very flat angle which rolls up an enormous duty for them to perform. In the Bollman bridge (fig. 3) the loads on each panel are equal, and are at once transmitted as I before remarked by tension rods to the abutments. The spans of these bridges are limited very

Fig. 1

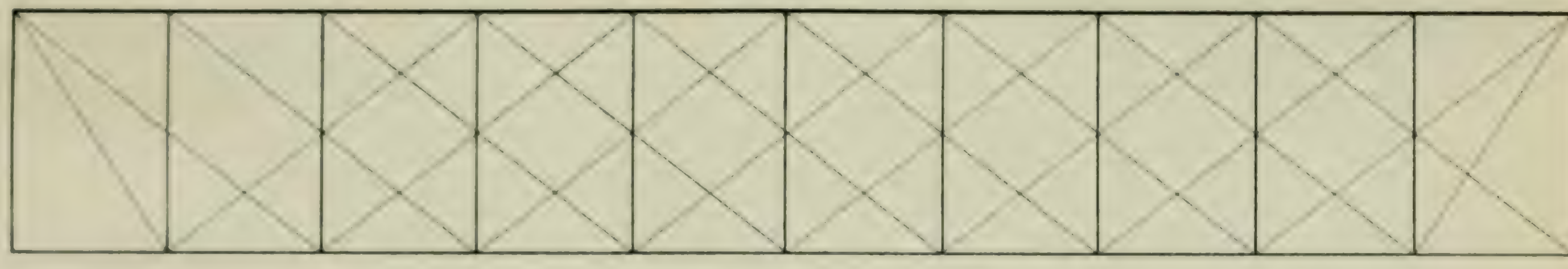


Fig. 2.

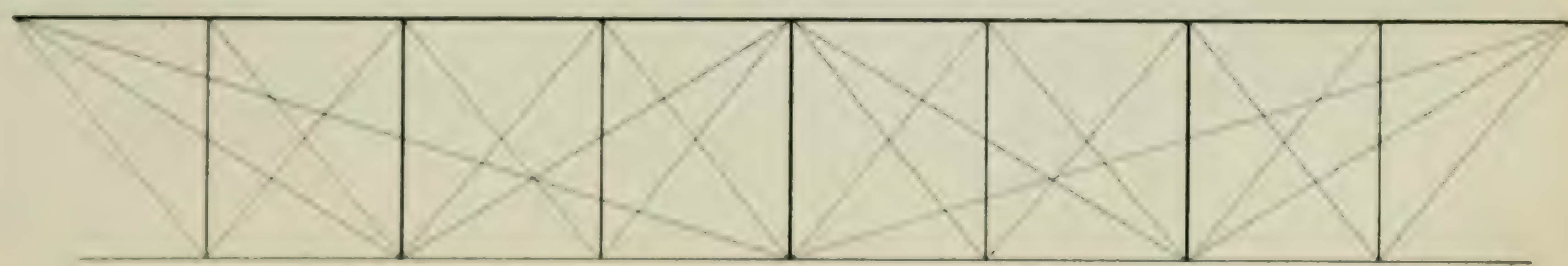


Fig 3

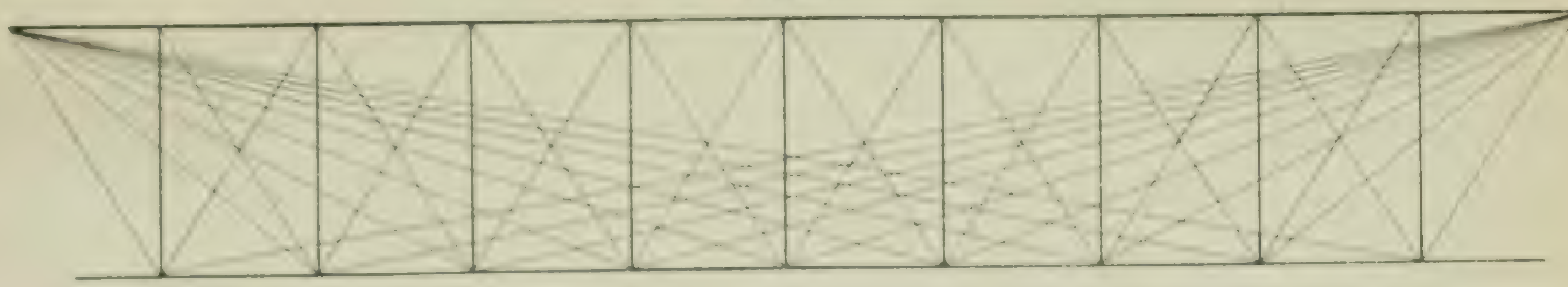


Fig 4

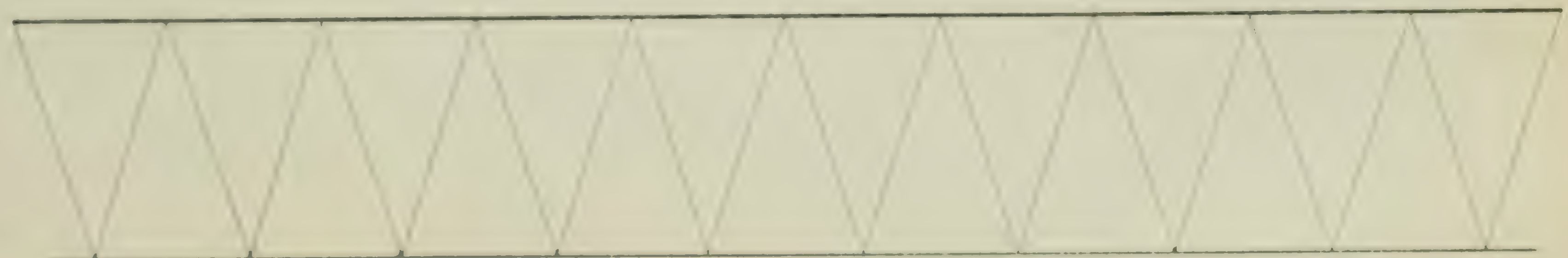
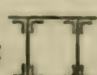


Fig 5.

Lith of C Van Benthuysen & Sons, Albany

quickly after passing 150 feet, more rapidly, however, in the latter than in the former, as the numerous long rods cause great vibration. Some Fink bridges of 200 feet span, have been built on the line of the Baltimore and Ohio railroad, which, I believe, give satisfaction. The Bollman bridge is not a stiff bridge at all, nor can it be made so, for even take a span of fifty feet, the tension rods would be over fifty feet long and at a very flat angle, rendering it impossible to make them taut, without bringing an undue strain upon them. Both these bridges have considerable merit, and although they cannot be looked upon, as you readily perceive, for the great spans required over the East river, this paper would be incomplete without noticing them. This same remark applies to the triangular truss so much in vogue in England, and represented in this diagram (fig. 4).

It is the simplest of all trusses, and exceedingly easy in its computations. The Newark Dyke bridge (England) is the longest span ever erected on this principle, and is 240 feet, on a skew of ninety-seven feet. The proposed International bridge over the Niagara river, at Buffalo, upon which I was engaged while engineer of bridges for the A. & G. W. Railway, was to be in spans of 250 feet, and to be built entirely of wrought iron (boiler plate). The streets of the I——I section made from plates and angleirons melted together, the ties of plates merely, and the chords were to be box shaped, thus:  This system of truss is open to the same objections to great spans that was mentioned in connection with the Whipple bridge, viz.: the transmission of weights, always increasing, by a series of triangles to the points of support. The Lattice bridge, shown below (for which America must get credit, as the system was used in timber bridges long before Sir John MacNeil thought of introducing it on the other side, in wrought iron), comes properly under the head of trussed girders, the diagonals being multiplied, but acting in the same way as before described (fig. 5).

In addition to the difficulties in adapting this description of truss to long spans, the lattice arrangement is very deficient in vertical strength, which becomes very markedly so towards the abutments, requiring various stiffening arrangements to keep the chords in their proper position. There have been some bold examples on this principle, which bid fair to be outstript by the

erection of a proposed lattice bridge over the Frith of Forth, between Blackness and Charleston, about 14 miles from Edinburgh. This bridge is to be in four spans of 500 feet each, and 64 feet deep, and 125 feet above high water. Although I have not had the good fortune to meet with any more than a meagre description of this bridge, I apprehend that the lattice system is not alone relied on, but that chains or tension bars are introduced to take the load, the lattice system being merely a counter-brace to the chains and a support to the roadway. This of course is merely a surmise on my part, for without some such arrangement, I do not see how the tremendous effort to buckle the lattice bars towards the ends of the truss can be counteracted, without immense weight being added in the form of gussets, angle irons and streets. I think I can give you in a few words an idea of the maximum strains on a trussed beam, when the weights are carried from panel to panel. The strength of any beam is proportional to the square of its depth, and there is one stage in varying the depth of a truss, in which the maximum compressive strains in the top chord, and the tensile strains in the bottom chord, are exactly equal to the greatest weight of the truss when loaded. And that takes place when the depth is equal to one-eighth the span. Let us take a pair of girders of 650 feet span, one-eighth of which would be 81¼ feet. Such girders would weigh, together with their greatest variable load (allowing 20 feet for roadway), about 3,000 tons, which measures the compression exerted in the upper chord, or tension in the lower; half of which, or 1,500 tons, must be sustained by the end diagonals and verticals. Without unwieldly proportion of parts, the resistance to flexure of verticals 81¼ feet long would be very small, when an enormous duty, as you see, devolves upon them.

Suspension Bridges.

We come now to consider the elements and principles of the *suspension system;* a system every one naturally turns to when the problem that called forth this paper is presented for solution because of its adaptation to long spans, its ease of construction, doing away entirely with false works, and the grace and beauty of its appearance. Now, in itself, a suspension bridge is only immensely strong when simply regarded as supporting a dead weight—it has no element of stiffness whatever. The slightest unequal loading will throw it out of equilibrium and produce a tremor in all its parts,

eventually leading to destruction. This stiffness must, in some way or other, be supplied in order to make the suspension bridge useful, and it is done in various ways, depending, of course, upon the nature of the work that it has to do, whether it is to be used for the purpose of the railroad, viaduct, or aqueduct. Weights, girders, trusses and stays all come into play to attain this end, and accomplish it too successfully, when used together in a judicious combination. Mr. Roebling's bridge, over the Niagara river, is the best example extant of what may be done, and was a grand triumph in the face of the sneers of all the European engineers in its adaptation to railway purposes. I would that I had time to take you through all its beautiful construction and show how exquisitely Mr. Roebling has provided for every contingency, for it is a work of which all Americans should be proud; but it would lengthen out a paper that, perhaps, is already too long for you, and I forbear. For lack of the above mentioned combination, the Wheeling bridge of 1,000 feet span was blown completely over by a gale a few years back. Here weight alone was relied upon, which acquired such a momentum by the constant heaving and falling of the platform, that it became really an element of weakness. In the Niagara bridge, above mentioned, there are trussed girders, under and overfloor stays, which assist in multiplying stationary points. This idea of stationary points must always be kept in view in designing a suspension bridge, for the most rigid bridge is the one that has the greatest number of permanent points. Although a suspension bridge satisfactorily answers most of the requirements of our case, still there are grave considerations to be disposed of before it could be recommended for the end in view. Suspension bridges usually cross ravines, the high ground on either side forming the base of the land towers. In the case before us we have no natural height thus provided for us, the land on either side being very low, so that we must have enormous masses of masonry to withstand the great pressure of the towers themselves, and the load that they have to support. Then, again, the land cables strike their anchorage a long distance into the heart of the city, necessarily destroying much invaluable property. Not alone in their angle do they absorb room, but if you will think for a moment of the weight and extent of masonry required to hold them fast and secure, you will readily understand that this encroachment is a matter of considerable moment. Let us take a span of 1,350 feet, with double roadway and footwalks, and see

what the elements are, from which you may draw what conclusions you please. In the first place our bridge must be 140 feet high, to the under side of the roadway. With span as above assumed, the versed line of cables would be a minimum at $\frac{1}{15}$ the chord line, or say 90 feet. This gives a total height of 230 feet, or only 50 feet lower than Trinity church steeple. The angle formed with the vertical would be 75° 04′, necessitating a distance into the city of 876 feet before striking the surface of the ground, which would be the commencement of the anchorage, unless the masonry was carried up a considerable distance above the surface, when the anchorage would move proportionately towards the river. Such a bridge would weigh, with its maximum load, about 10,000 tons, causing a horizontal strain in the cables of over 18,000 tons, bearing upon the summits of the towers with a crushing force of 5,000 tons, and endeavoring to pull up its anchorage with a force of over 19,000 tons. When you reflect upon the great mass of this anchor masonry, the magnitude of the city termini can better be understood, and must be one of the governing points in the selection of this system of bridging for the East river, irrespective of the question of cost. It is in view of these facts, that I present for your consideration the following system, as illustrated in the subjoined diagrams.

Material to be Used.

Before doing so, however, I desire to say a few words about the material that I propose to employ, and also the reasons that induced me to assume a high unit of safety. Could we have a material possessing strength without weight, and in all other respects applicable to bridge construction, the amount which would be used for various spans, would be in proportion to the squares of the width of openings, and spans of infinite length would be practicable. In a bridge, part of the work that it has to do, is made up from the absolute weight of the material used in its construction, and therefore the limit of space is reached in all bridges, when the dead weight or permanent load, would overtask its powers of resistance, involving, of course, its destruction. To double a span, and retain the strength of a bridge, would quadruple its weight, so that its loads would increase twice as fast as the increase of strength. Thus in the Britannia bridge of 460 feet span, with all the skill brought to bear in the distribution of material, the strain is given as six tons to the square inch (London

Engineer), resulting from its own weight, while increasing the span to 1,600 feet, it would fall with its own weight alone. Just see what a gain, if some material of great strength could be substituted for wrought iron : and we have it. So soon as the arts and sciences demand a forward march, some one is ready to take the lead. In the want expressed above, Mr. Bessemer has nobly come to the front, and presented the profession with a method of making steel in large masses, and applying it to all principles and details of construction. This invention of Mr. Bessemer is slowly instituting a perfect revolution in the mechanic arts, and steel now bids fair to usurp the place of wrought iron in a great degree. Certainly in all cases where strength combined with light weight is demanded, and often a necessity. By its judicious use we are enabled to accomplish results that have hitherto been deemed, if not impossible, at least problematical. It seems surprising to me that so few have given attention to its use in girders and trusses of all descriptions, and I can account for it in no other way than the general disposition of professional men to have some one else lead in an innovation, and demonstrate a success that cannot but be foreseen from well established facts and experiments. Thus far there have been but two steel bridges built ; the first, the one built by a Mr. Worthington over the Sankey canal, England ; the second will greet the visitor to the World's exposition to be held this spring at Paris. The former is a swing bridge in four girders, of fifty-six feet in length, and weighs but *five-eighths* of what a wrought-iron bridge of the same pattern would weigh. The latter is a tressled arch bridge, of eighty-two feet span, and was submitted to enormous tests, which were satisfactory in the highest degree.

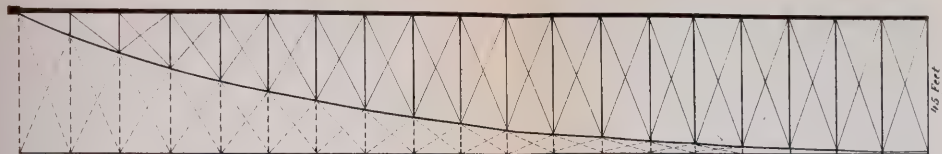
A proposition was broached some two or three years since to span the straits of Messina with a single span of 3,300 feet, of course on the suspension system. These and many other considerations led me to adopt steel as the material to be employed in the plan suggested, but none have had a greater weight with me than the study of Mr. David Kirkaldy's exhaustive experiments, made at the works of Messrs. Robt. Napier & Son, Glasgow, and extending over a period of nearly four years. No expense was spared in making these experiments under all conditions, and they are to be regarded as eminently trustworthy, and a positive guide to the profession in designing works of both iron and steel. His numerous experiments upon forged steel of the best quality, showed a

tensile strain, when cooled in the ordinary way, from 90 to 120,000 pounds to the square inch, but when cooled in *oil*, the resistance to the tensile strain rose from 12 to 56 per cent., according to the quality of the bar tested, the average being 40 per cent. Taking a judicious mean of his experiments upon the latter mode of cooling, gave a result of from 53 to 69 tons per square inch of section. I have, therefore, assumed in my computations 15 tons to the square inch as a safe unit, little less than one-fourth the breaking strain of the best quality. For a railway bridge I would allow a greater margin for safety, to absorb the incidental shocks of heavy machinery, but the case before us, when at best the weight of the variable load is so disproportionate to the weight of the permanent load, that I believe the above limit to be ample provision. When compressive forces are called into action, the safe limit assumed for forged steel is 12 tons to the square inch, the ratio of steel to tension and compression being taken at the same ratio possessed by wrought iron.

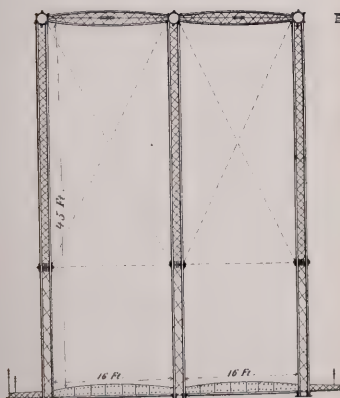
Description of the Proposed Bridge.

I have called this system in my classification the *trussed suspension system* (Fig. 6). Recognizing the great strength in the suspension bridge, I have adopted the principle to carry the load, but do away with the high towers and anchor masonry entirely. This is done, as you notice, by causing the chains to react against a horizontal member, in the manner shown, which member is kept in place by an arrangement of diagonals and verticals. It is, in a few words, a trussed furncular polygon, to which class all trussed girders belong, of the trapezoidal form, used so much in all departments of construction. A trussed purlin, by means of the under struts and suspension rods, call into play the same forces, only in a modified degree. The elder Brunel constructed an enormous trapezoidal truss over the Wye, at Chepstow, the span being thre hundred feet. There are but *two* under struts, supporting the horizontal member, which was composed of boiler-plate $\frac{5}{8}$ iron, and made tabular, with a diameter of nine feet. The depth of truss is, I believe, 50 feet, the railway passing under the tube and through the struts. I make these remarks to show you that I am attempting nothing new, only putting on a large scale what you every day see before you. The diagram connected herewith represents one span of 650 feet, there being two in the design, supported by a central pier. You will notice that the design is

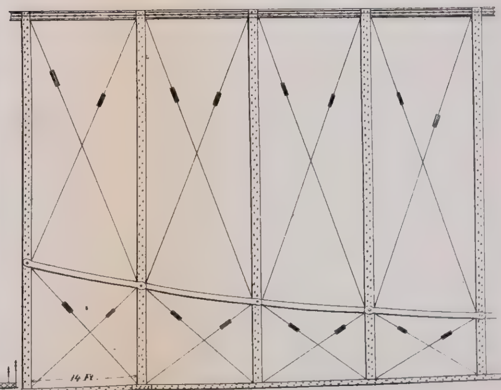
Fig. 6.



325 Feet, half Span.



Cross Section.



Elevation.

Lith. of C. Van Benthuysen & Sons, Albany

in two *distinct* parts—the sustaining truss and the roadway—both acting independent of each other. The principal dimensions are as follows: Clear width of each roadway 16 feet; of each foot walk 6 feet; verse sine, or deflection of chains 45 feet; centre to centre of panels 14′ 09″, and of which there are 44. The curve of the chains is a true parabola, since that is the uniformly loaded condition assumed by the catenary, the curve of the freely suspended cord. The greatest load that ever could come upon one span, such as a dense crowd, together with the weight of the span itself, would be about 3,650 tons, of which the side trusses must support 1,150 tuns each, leaving 1,350 tons for the duty of the middle truss. This loading would induce a horizontal strain in the chains of 2,075 and 2,437 tons, respectively, for each side and the middle truss, which would increase at the piers to 2,158 and 2,664 tons. This, then, tells us what provision to make in the chains, and having before taken 15 tons per square inch as a safe limit, we require a sectional area of 140 square inches at the center of the side chains, swelling proportionately to an area of 144 square inches at the ends, while the middle truss requires at the centre 162, and at the ends 177 square inches. Ten links, therefore, each $1\frac{3}{16}'' \times 12''$ are required to resist the horizontal tension of the side trusses, as you see in the diagram, while the middle truss requires for the centre chains, 12 links, each $1\frac{1}{8}'' \times 12''$. These links are 15 feet long, more or less, according to inclination, the fibres composing which are continuous, that is, the heads are not formed by welding, but are swelled out the proper size, the holes for the eye-bolts being afterwards drilled very accurately to size. The bolts themselves are turned carefully, fitting the above drilled eyes very truly. These piers being exposed to a shearing stress at each set of opposite links, the diameters required would be $4\frac{1}{2}$ and $5\frac{1}{2}$ inches for the two sides and middle trusses, respectively. The force which the chains exert at the abutments and pier may be decomposed into two, the one vertical, the other horizontal. Of course the vertical is counteracted by the support of masonry, while the horizontal one is taken up by the chords, as you perceive in the diagram shown by the arrows. These chords are composed of rolled segments of a cylinder, thirty inches in diameter, with lips, between which are inserted radial pieces, the whole being riveted together. The area required is of course, $\frac{1}{12}$ the horizontal strain (since we have taken twelve tons per square inch, as the unit of safety for compressive strains). These chords are continuous,

there being no disconnected pieces, as their manner of construction allows. The chains are secured to its ends by passing through a cast-steel saddle (against which the chords abut) where they are pinned, the centre of the pins being in the axis of the chords. The chains and chords are separated and kept in position by means of verticals acting either by thrust or tension, and diagonals break the panels thus formed into triangles. These verticals are formed of plates of steel and angle irons of I——I section, connected by a lattice webbing—the whole properly rivetted together. The sectional area of each street is eight square inches, and they are so proportioned as not to be greater than eighteen diameters in length. The diagonals are rods one and a quarter inches in diameter, grasping the chain pins at one end, and at the other secured between the lips of the horizontal members. Their tension is adjusted by means of turn-buckles. In this consists the vertical stiffening, and the arrangement for keeping innumerable points. The lateral sway bracing is similarly heated; the tresses being separated from each other by means of light open work webbed steel streets and rods, the rods at their intersection meeting in a ring where they are screwed to their bearing and thus adjusted. The support for the roadway is now completed, and you have the whole sustaining power before you. The roadway itself is swung from the chains by means of *streets*, which, in connection with the diagonals, form the stiffening element required to absorb undulations, or in fact keep them out. The Williamsport suspension bridge consists of *no more* than this; the suspenders being posts (hung upon the wire cables) every twenty feet, the panels thus formed being tied diagonally with inch rods (Franklin Institute Journal, May 1866). This is the third suspension bridge erected with suspender streets. Mr. Murphy, C. E., having the credit of introducing the modification, which experience shows possesses a remarkable degree of stiffness. These suspension streets are similarly constructed as those of the trussed chains only lighter, the plates being but ⅜ inches thick, and the angle irons 3x⅜. I speak of suspension struts, a seeming incongruity, but they act positively with reference to the load, and negatively with reference to the absorption of vibrations. Two continuous steel plate I-beams clasp the bottom of the suspenders, represented by the lower horizontal line in the diagram. These beams are 16 inches deep, their bearing points being, of course, at every panel 14′ 09″ apart. Diagonal truss rods, with turn buckles for adjustment, break up

the panels, similar to those belonging to the trussary of the chains and top chord. The cross girders are two in number for each panel, and are parabolic in form, curving from 18 inches in the centre to 12 inches at the ends, which ends project far enough over the sides to form the cantilevers of the footwalks. These cross girders are secured to the longitudinal 16-inch beams, which I have before described. Between each pair of cross girders T irons are sprung in segmental arches, feather downwards, having riveted to their plate side corrugated iron. The spandrils thus formed are filled up level with the girders, by means of a light concrete of bitumen and cork, and the whole paved with oaken blocks. This will make a strong and elastic flooring, as well as being impervious to water. The railing of the footwalk is five feet high, formed of light two by one-quarter inch bars, latticed together, and riveted at intersections formed by their crossing. Of course, this railway will have to be laterally stiffened at each panel by a suitable strut. So much in general terms for the construction of each span, which I hope you fully understand.

The Central Pier.

I wish now to say a few words with reference to the central pier. As to the abutments, they will have to be the same for any bridge, and they therefore require no explanation. A pier has many objectors, and whether their objections are based upon tenable grounds, it remains for me to discuss the effect of a pier in the centre of the river, as well as the problem of construction. I regret exceedingly at not being able to get accurate information of the bed of the East river, in lieu whereof I must assume certain data, such as depth of water, character of bottom, and velocity of currents. Viewing the past, and having that experience to go by, the sinking a pier in a mud bottom, in say sixty feet water, with a current of two feet per second, is not a work of unsurmountable difficulty. Huge wrought iron cylinders, so successfully used the past few years, could be put in at a *comparatively* small cost. It may be a matter of interest to recall the sinking of the huge piers for the Saltush bridge, by Brunel, Jr. This pier was sunk in 82 feet water, the tide running and falling 18 feet, by means of a wrought iron cylinder, of 37 feet in diameter and 90 feet in height, 16 feet of which pierced through the muddy bottom to solid rock. The same process was intended to be applied in sinking the piers of the proposed International bridge at Buffalo.

Here the water at the pivot span is 40 feet deep, the current running some four miles an hour. The cylinder designed was to be 40 feet in diameter.

Contraction of Water-way.

Let us see now in what way the velocity of the river is affected or, in other words, the contraction of the water-way. Assuming the average depth of 60 feet, our pier would present an area against the stream of say $40 \times 60 = 2{,}400$ square feet. The original area of the channel being, say, $60 \times 1{,}350 = 81{,}000$ square feet, the ratio being nearly as 1 to 34. The mean velocity of the natural water way being 2 feet per second, that of the contracted way would be $m\frac{S}{s}V = 1.097 \times \frac{81000}{78600} \times 2 = 2.24$ feet per second (m is a constant according to du Buat; S=original area; s=diminished area; and V=original velocity.) The increase is, you see, .24 per second or 864 feet per hour, an increase of speed that could not be noticed except by careful measurements. The fall corresponding to this velocity is $\frac{3}{4}$ inch, (fall$=\frac{V^2\ m^2\ b^2}{64c^2} - c^2$ so that you see the apprehended injurious effect upon the river current amounts almost to nothing at all when examined in the light of figures. The office of masonry being to distribute pressure over a great area, after the superincumbent weight has been provided for, the piers and abutments should be built cellular, in well bounded courses tied together.

Changes by Variation of Temperature.

The effect of change of temperature in the superstructure is provided for, in mounting the end cast iron saddles to which the chains are attached, upon steel rollers, secured in a frame, rolling upon a plate imbedded in the masonry. This would be all the provision needed, since the material employed being all of the same kind and character, the contraction and expansion would be the same. The expansion of steel would be about .0000067 of its length for every degree Fah., which for 100 degrees (taken as extremes of temperature in this latitude) would cause a variation in length for 650 feet, of .435 feet or $5\frac{1}{8}$ inches or $2\frac{9}{16}$ inches at either end of each span. This in the horizontal member. The chains being 658 feet long they would have an additional increment of expansion or contraction, due to the additional eight feet, amounting to $\frac{1}{16}$ of an inch at the center, which, of course, would be inappreciable in effecting a change of versed sine. The matter

ERRATA.

On page	894,	from bottom	12th line,	read "facilities" for "faculties."	
" "	"	" "	16th line,	read "forces" for "forms."	
" "	897,	" "	18th line,	read "struts" for "streets."	
" "	"	" "	17th line,	read "riveted" for "melted."	
" "	900,	" "	8th line,	read "span" for "space."	
" "	901,	" "	15th line,	read "trussed" for "tressled."	
" "	902,	" "	15th line,	read "funicular" for "furncular."	
" "	903,	" "	11th line,	read "8" for "4½ and 5½."	
" "	"	" "	" "	strike out "respectively."	
" "	904,	" "	10th and 19th lines,	read "struts" for "streets."	
" "	905,	top line,	read "trussing" for "trussary."		
" "	"	from top,	16th line,	read "roadway" for "railway."	
" "	"	" "	17th line,	read "suitable bracing" for "suitable strut."	

of erection would be accomplished by building on shore upon scaffolding, the *trussed chain*, floating it to the intended site upon pontoons, and raising it to its position by means of hydraulic presses, precisely as was done with the Britannia bridge, and needs no elucidation as to its feasibilty. In this work a forty horse engine applied the power through a pipe $\frac{1}{8}$ inch bore, into a cylinder 20 inches in diameter, having a ram $18\frac{3}{8}$ inches in diameter. I estimate the cost in gold of the proposed bridge complete, with abutments and pier, at $750,000.

In the foregoing remarks our subject was necessarily handled in a very sketchy manner, necessitated by the limits of my paper. I aimed at being brief, and, in so doing, I may not have been as clear in some points as you may have desired. In touching upon existing examples, I have only done so in order that you may see what *has* been done and, taking comfort thereby, we can better comprehend what may be done. If I have been the means of developing a few points for the intelligent consideration of the subject now before the public, I am satisfied, and in retiring, I beg leave to thank you for your kind attention to me this evening.

At the conclusion of this paper the Association adjourned.

American Institute Polytechnic Association, *April* 4, 1866.

Prof. S. D. Tillman Chairman. T. D. Stetson, Esq., Sec'y.

The following notes on new discoveries and inventions were presented by the chairman:

Coal Near Mobile.

The newspapers of Mobile, Ala., announce the discovery of valuable veins of coal within a convenient distance to that city.

To Prevent the Fading of Photographs.

It is well known that the spontaneous decomposition of the hyposulphites used in fixing the photographic picture is one of the chief causes of fading. Several processes have been proposed for remedying the evil but none seem to have answered the purpose. Recently, Messrs. Tichborne and Robinson, of Dublin, Ireland, have devised a process to eliminate the hyposulphite without producing any counterbalancing injury. It consists in washing the print in a bath composed of a mixture of baryta and perchloric

acid. This mixture has the effect of removing all traces of hyposulphite without generating any deleterious compound or disengaging free chlorine gas, which would attack the metalic silver in the pictures.

Spectrum of the Vapor of Water.

Mr. Jangsen, under the patronage of the Minister of Public instruction of France, has, by a series of experiments, proved that certain lines in the solar spectrum of variable intensity, first discovered by Sir Edward Brewster, and termed by him telluric rays, are not caused by water in solution in the atmosphere, but are the direct effect of water vapor, as had been previously conjectured by Father Secchi. When light is passed through a tube filled with vapor, under the pressure of seven atmospheres, it shows the principal telluric rays. Janssen dissents from the conclusions of Kerchoff, who attributes a portion of the lines in question to potassium. The red and yellow being found more brilliant than the blue and violet in the spectrum of water-vapor, the color of the vapor should be orange; this also accounts for the red of the rising and setting sun, or the sun when seen near the horizon.

A Normal Map of the Solar Spectrum.

Prof. Walcott Gibbs, of Harvard University, in a memoir read before the National Academy of Sciences, described his Normal Map of the Solar Spectrum, in which each spectral line is entered according to its wave length, as first suggested by Billet. The well known chart of Kirchhoff, though executed with great care and labor, is not, properly speaking, normal, since it only represents a spectrum formed by four flint glass prisms, the angles of which, it is true, are given, but of which the indices of refraction are not stated. Moreover, the prisms were not placed accurately in the positions of least deviation, for each of the spectral lines. Prof. Gibbs obviates these objections by making a standard map wholly independent of the peculiarities in the form of apparatus, in the number of prisms, their refractive and dispersive powers, and their positions. His map is based on the wave lengths of spectral lines, which do not vary with the material of which the prism is composed. Angström's measurements were selected as standards; these being in ten-millionths of a Paris inch, have been reduced by Prof. Gibbs to millionths of a millimeter. A new method of determining wave lengths by comparison was described

by the author. The chart accompanying his paper contained the wave lengths of 187 lines, with a probable error not exceeding two-millionths of a millimeter. The lines being ruled by a dividing engine upon a copper plate, are correct upon the chart to about one-tenth of a millimeter.

A New Chloride of Lead.

Prof. Nickles, of France, has formed a new compound called perchloride of lead, by exposing the chloride of lead to the action of a current of chlorine in a solution of chloride of lime. The perchloride thus obtained is a yellow liquid emitting a strong smell of chlorine, and is a powerful agent for communicating that element to other substances. It will dissolve gold, and produces, with aniline and the analogous compounds, those beautiful colors for which these substances are so remarkable. With morphine it yields a color similar to that of the horizon at sunrise, and with bucine a rich cherry-red. Now bucine and strychnine, both vegetable bases extracted from nux vomica, are very difficult to distinguish from each other, and here perchloride of lead steps in as a useful agent; for it so happens that it does *not* produce red with strychnine as it does with bucine, and may therefore be used to distinguish one substance from the other. It serves the same purpose with regard to morphine and the other alkaloids of opium. Salts of lead and bismuth may also be distinguished by perchloride of lead, since it precipitates the former from their solutions, and not the latter. It will carbonize cane-sugar and not glucose, and blacken analine without producing any effect either on fecula, starch or dextrine. Like other perchlorides, it combines with ether to form a very caustic compound, which attacks both gold and platinum, beside other metals.

A Pest in Chignons.

Mr. Lindermann, a German naturalist, has given in a medical periodical published at St. Petersburg, Russia, an account of a newly discovered species of entozoa, found in large flocks, and therefore called gregarine, from the Latin *grex.* It belongs to the lowest class of animal organisms, and exists as a parasite in human hair, forming numerous small dark-brown knots usually at the ends of the hair. It is also found in other parts of the body, and even in the blood, where it swims about until it grows too large to enter the hair, and often becomes imbedded in the

marrow. Gregarines multiply so rapidly as to clog the blood-vessels, thereby engendering dropsy, asthma, albuminuria, and other dangerous diseases.

Mr. Lindermann made microscopical examinations of thirty samples of hair procured from a dealer in hair in Central Russia, twenty of which proved to be infested with gregarines. He ascertained that these specimens came from a filthy class of people living on the banks of the Wolga, whose uncleanly habits engender the disgusting pediculus (louse) on the body of which gregarines exist as parasites, and from which they pass into the human hair. Gregarines do not die when the hair is dried, or even when it is placed in boiling water, and as acids, alkalies, and ethers would destroy the hair as well as the parasite, artists in hair have been compelled to use the material in a state of impurity and have constructed their beautiful waterfalls or chignons regardless of the gregarine.

In prosecuting the inquiry as to the manner in which these parasites penetrate the human body, Mr. Lindermann found that a moderate degree of warmth, particularly when the body perspires, is sufficient to enliven them, when they begin to grow, and in the course of a few hours are able to propagate their species. The finely divided state of the very thin layers of "false hair" sometimes worn by ladies, nearly all of which is imported, is particularly favorable for the escape of colonies of young gregarines which, flying about in the air, may be either inhaled, or carried into the digestive organs with food, and finding their way into all parts of the body, they thus engender disease.

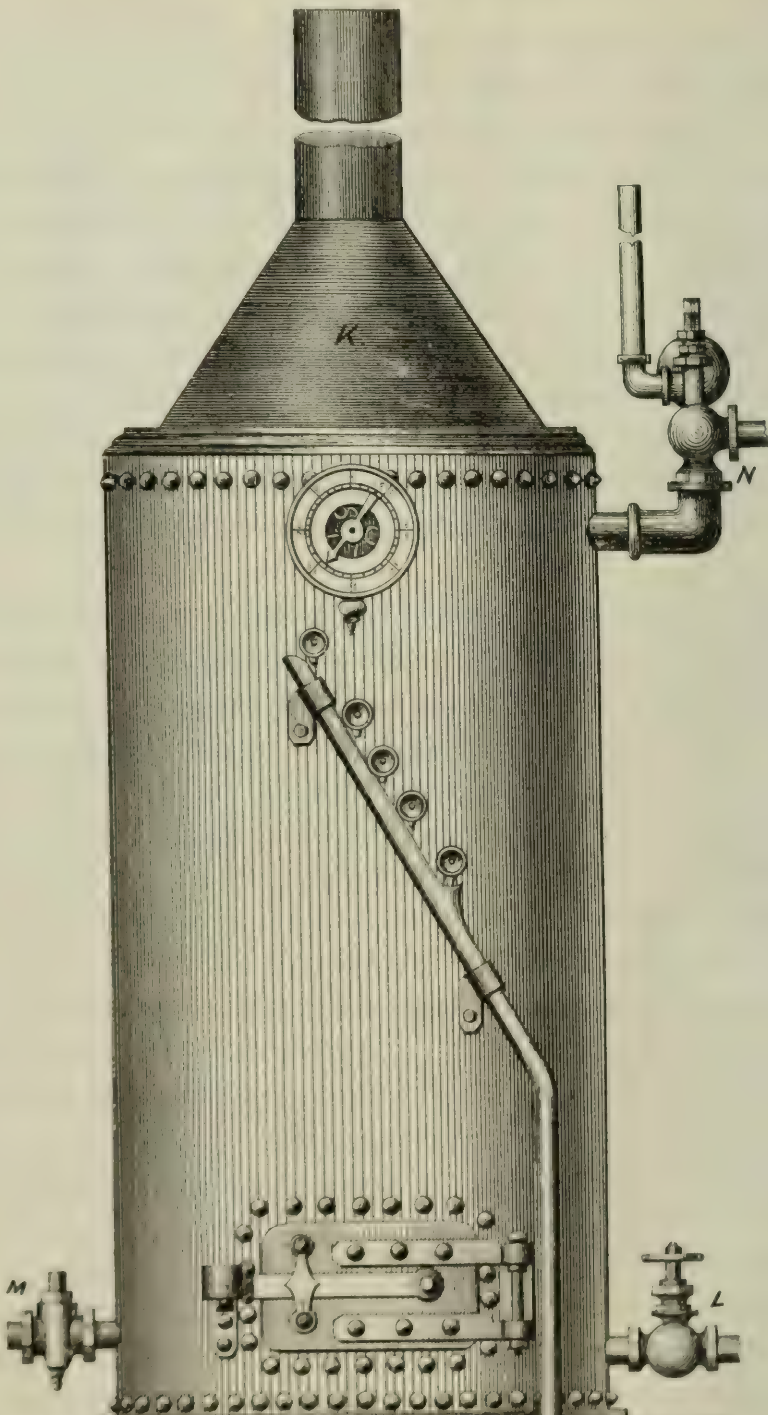
The facts set forth by Lindermann are of too serious a nature to be passed over without eliciting further inquiry. The *London Telegraph* contains an account (hardly to be credited) of an experiment with one hundred and fifty hairs selected, with the aid of a microscope, from a chignon sold by a fashionable hair-dresser.

A writer in *The London Review* attempts to throw doubt upon the statement in *The Telegraph*, but does not profess to have made any experiments. He endeavors to quiet English ladies by the statement that most of the chignons worn by them are made of hair from France and Germany, and not from the filthy Burlakes of Russia.

The Hicks Boiler.

Mr. James M. Hicks, of New York, exhibited a beautiful glass model of his new boiler, so constructed as to produce complete

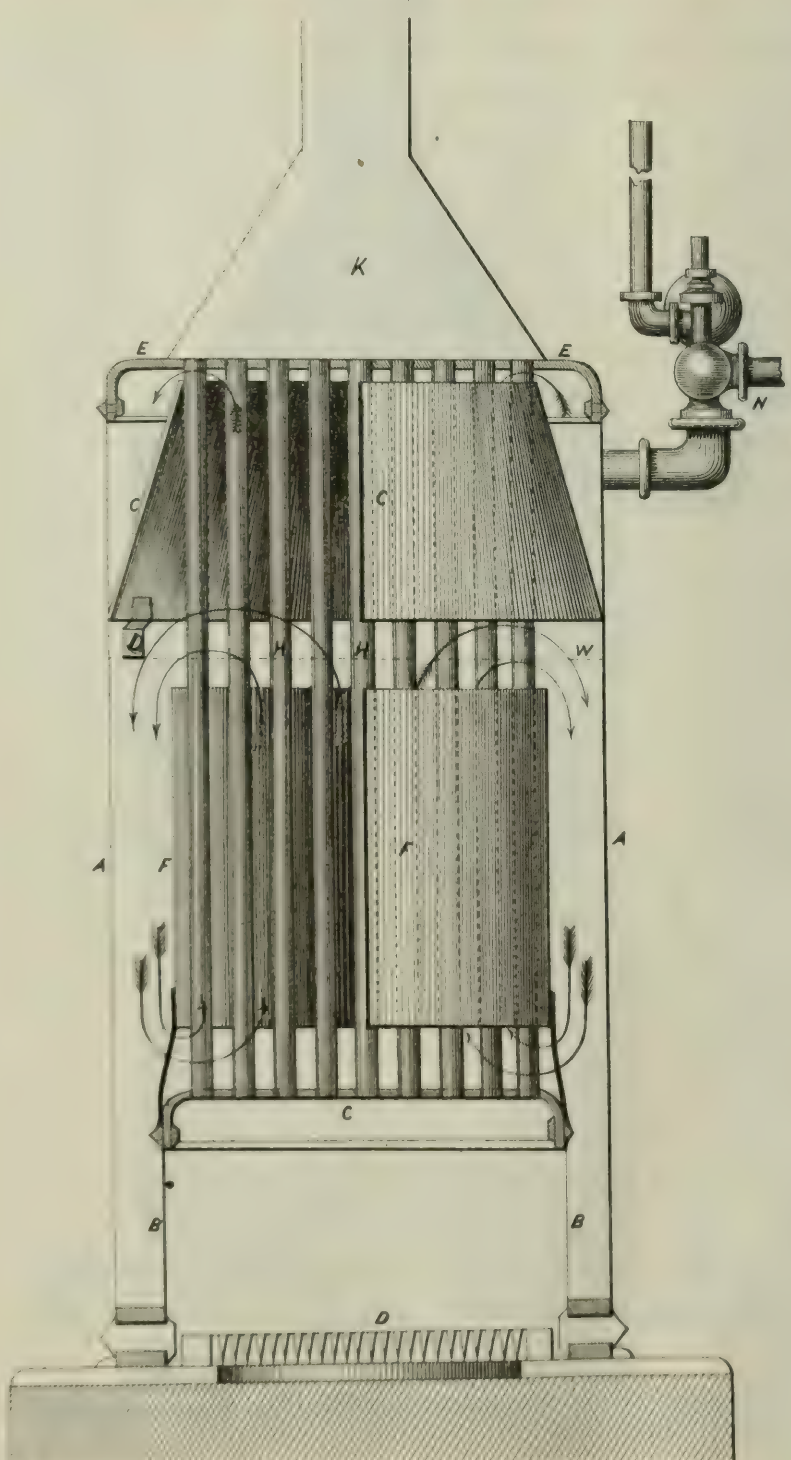
THE HICKS BOILER.



Outside View.

Benthuysen & Sons Albany N Y

THE HICKS BOILER.



Vertical Section

circulation of water within it. A flame was applied to this model and the rapid circulation of the water was made visible to the whole audience.

The object of this new invention is to overcome the objections to, and prejudice against the ordinary upright and other forms of boilers, in which, on account of the want of proper *circulation*, the sediment collects upon the crown sheets and between the tubes, thus destroying the utility of the most important heating surface; and in which the upward and downward currents so interfere with each other, that it is impossible for the water to return to the bottom, and be presented to the heating surfaces in a solid form.

Its superiority consists in the fact that it accomplishes the following objects indispensable in a safe and efficient boiler, viz.: It circulates the water in a body, (as will be seen by reference to the drawings and description), thus passing it over the steam making surfaces rapidly, keeping them at the best steam making temperature, and taking the heat away from them as fast as they gather it.

The circulation also, keeps the sediment from settling on the tube sheet, and deposits it in the fire box legs, which fact is proven by the experience of a year or more, with the dirtiest kinds of water.

The beneficial results of this boiler may be thus summed up. 1st. It prevents foaming. 2d. It prevents incrustation. 3d. It gives dry steam. 4th. It keeps the fire surfaces covered with water. 5th. It gives equal temperature. The boiler, it will be seen, is simple in construction and very strong; it is easily set up and readily repaired.

The description of the boiler and its operation will be understood by a reference to the annexed illustration.

The vertical section through centre of boiler, shows the steam-drying cone and circulating cylinder, part in section and part outside view.

A is outside shell of boiler. B is the fire-box sheet.

C is the lower tube-sheet. E is the upper tube-sheet.

D is the fire-grate, resting on the foundation plate.

F is the sheet-iron circulating cylinder or thimble around the tubes, kept in place by being braced to the fire-box sheet; extending from a short distance above the *lower tube-sheet* to the *water-line*, dividing the water among the tubes from the water near the outside shell of the boiler.

G is the sheet iron *steam-drying cone* around the upper part of

the tubes, extending from a short distance above the *water-line* to within about half an inch of the *upper tube-sheet*, fitting at its lower edge the inside of the shell of the boiler, (to which also it is fastened), and the tubes at its upper edge. *It thus forms a steam-chamber* between the cone and the outside shell of the boiler, into which the steam can only pass by going over the top of the cone.

H H are tubes fastened into the lower and upper tube-sheets.

K is the smoke-pipe. L is the blow-off cock.

M is the water supply-cock. N is the steam-valve.

W is the water-line.

Water is run into the boiler through M to the height W, filling all the spaces between the shell and fire-box and tubes. The fire being then started in the fire-box, heats the lower tube-sheet, tubes, and fire-box sheets. The water directly over the fire among the tubes is, of course, heated first, and, expanding, rises over the top of cylinder F, and flows over into the space between F and the shell of the boiler, (the water previously surrounding tue cylinder being drawn in to fill its place.) A *current* is thus started *up* the centre and *down* the sides, which is *rapid* in proportion to the *intensity* of the heat in the tubes and fire-box. The *circulation* causes a regular action and an equal temperature to the water, and *sweeps off* the bubbles of steam which naturally cling to the steam-making surface. The steam that is thus carried up to the cone G *is pure steam*, the *water* separating from it at the water-line and passing down again with the current. It also prevents the tubes from getting above the *best steam-making* temperature, as the higer temperature, only quickens the circulation, and thus a *perfect balance* is kept up between the two. Thus by *utilizing* any possible degree of heat, we obtain the *greatest economy* of fuel. The circulation also sweeps the *dirt* and *sediment* from the water off the *tubes* and *crown sheets*, and *deposits* them in the space around the fire-box where the water is the most *quiet*, effectually preventing all *incrustation*—a most valuable feature. The steam after being delivered into the upper part of the boiler, is further *dried* and *purified* from any *water* which it may hold by contact with the upper part of the tubes, and then passes into the *space* between the cone and the shell of the boiler, whence it is taken through the steam-pipe into the *engine.*

This principle has been adapted to horizontal boilers, and is applicable to any desired form.

THE FIRST DAGUERREOTYPE PORTRAIT.

Mr. John Johnson, of Saco, Maine, said he noticed in the address delivered at the closing of the thirty-sixth annual fair, by Prof. John W. Draper, LL. D., as reported in the volume of Transactions of the American Institute, for 1865–6, on page 63, the following: "The first human likeness ever taken was by myself, in the University in this city." Mr. Johnson was confident that there was something on record relating to this point, and examining *The American Repertory of Arts, Sciences and Manufactures*, for the year 1840, he had found communications from Mr. A. S. Wolcott, who was for a long time his partner in the business of daguerreotyping, both in this city and afterwards in London, and also from Prof. Draper. The former claimed to have made his first profile picture of the human face in October, 1839, and the latter in December of the same year.

Mr. J. K. Fisher said he was personally acquainted with the facts in relation to Mr. Wolcott. The news of the great discovery of Daguerre came to this country through a letter from Professor Morse, who was at that time in Paris, which was received here in the early part of October, 1839. During the next year Messrs. Wolcott and Johnson opened a daguerrean gallery for taking portraits.

Several other gentlemen corroborated the statement of Messrs. Johnson and Fisher.

The following are the articles from Prof. Mapes' Monthly Magazine bearing on the point raised by Mr. Johnson:

Extract from "American Repertory" for April, 1840, page 193:

MR. A. S. WOLCOTT'S IMPROVEMENTS ON THE DAGUERREOTYPE.

In our last number we gave a full account of the daguerreotype as described by the inventor, with some observations relative to improvements thereon. Since this, Mr. Wolcott has completely revolutionized the process, and produced results heretofore unattainable. The inventor could not succeed in taking likenesses from the life, and indeed very few objects could be minutely represented unless positively white and in broad sunlight. Mr. W. commenced his experiments in October last, and one of his earliest observations led to the fact that, with the lens, the chemical and visual foci were not equi-distant, and therefore to obtain a perfect impression it would be necessary to bring both foci to the same point, so that at the point where the most perfect image was

obtained, the greatest strength of chemical action would take place. As all rays reflected, whether of light, heat or chemical action, are at right angles from the plane from which the reflection takes place, Mr. W. used a concave mirror instead of a lens, thereby not only doing away with the chief difficulty, but producing the result in a much shorter time. We have seen a number of minatures taken from life with this instrument, which are most striking resemblances of the originals. We cannot leave this subject without recording our humble opinion that Mr. W.'s improvement does himself and his country infinite credit. We received the following letter from Mr. Wolcott a few days since, which will fully explain his method :

New York, *March* 13*th*, 1840.

Dear Sir—When the announcement was first made of M. Daguerre's method of imprinting the beautiful images of the camera on silver plates, the remark was very generally made, that taking likenesses from life would be one of the most important uses to which it could be applied.

On reflection, it appears that on account of the difficulty of a person's remaining perfectly still for any great length of time, without the appearance of constraint, or without changing the expression of the face, the great desideratum was to construct a camera that should condense the greatest quantity of light to form the image that was consistent with distinctness. Not having an achromatic glass in my possession larger than the object glass of a microscope, I proceeded to experiment with a single concave reflector, as the most simple of all optical instruments, and as the one which, if of large dimensions and truly elliptical, would most probably best answer the above ends of distinctness and brilliancy combined.

My first experiment was, I think, in October, with a reflector of $1\frac{1}{4}$ inches aperture and 2 inches focus. With this I took the profile of a person standing opposite a window; and here having but the three principal facts relating to M. Daguerre's process, viz: The exposing the plates to vapor of iodine, afterwards to that of mercury, and the washing in hyposulphate of soda, or in common salt, I fell into the same error as probably many others, which was, that I supposed it necessary to keep the plate in the camera until the image was visible.

This error prevented my making a larger instrument immediately; that which I now use is 7 inches clear aperture, and is

used in the following manner: (Here is inserted a small engraving illustrating his reflecting camera, which is like one form of the reflecting telescope.)

The person is placed at A, and in the axis of the reflector B. C is the plate on which the image is to be formed. D D are rays radiated from the person and falling on the mirror B. E E are the same rays converging to a focus after reflector C is inclosed in a box to exclude the extraneous light.

From experiments which I have made, I find that a speculum, of 7 inches aperture and twelve inches focus, will form a picture in about the same time as a single lens of $3\frac{2}{3}$ inches aperture and 12 inches focus. Taking this as a standard of comparison, we may make an estimate of the action of lenses and reflectors.

In consequence of a lens inverting the image of an object, it will be necessary to use a flat speculum, in order to cross the rays; and, to reduce the aberrations, the lens should be a compound one, consisting of at least three glasses. If we estimate the rays lost by reflection from each surface as $\frac{1}{12}$ and the rays transmitted

by a single lens as	100.00
we have, loss by 1st surface of 2d glass	8.33
	91.67
Loss by 2d surface of 2d glass	7.63
	84.04
Loss by 1st surface of 3d glass	7.00
	77.04
Loss by 2d surface of 3d glass	6.42
	70.62
Loss by flat speculum $\frac{3}{8}$	26.48
Rays transmitted after one reflection, and refraction through three lenses, as compared with that transmitted through one lens of the same aperture	44.14

Now as 44 : 100 so is 100 : 227; that is if the area of the single lens is 100, that of the triple lens must be 227; and taking the square roots of the number for the apertures, we have $\sqrt{100}$: $\sqrt{227}$, so is 3.66, the aperture of the single lens, to 5.49 that of the compound one. With a lens, we are under the disagreeable necessity of placing it about $\frac{1}{40}$ of its focal distance nearer the

plate than the luminous focus, which may prevent that nice adjustment which is so desirable; besides, the question remains, whether the lens can be made to form as distinct an outline as the reflector. If I have not erred in my experiment with the lens and the reflector, it would appear that the chemical and luminous rays do not follow the same laws with respect to reflection and refraction. Thus it is estimated that there is a loss of about one-half the light from a speculum by reflection when the rays fall nearly perpendicular to the surface.

Call the rays falling on the speculum	100
Loss one-half	50
	50
Loss $\frac{1}{6}$ by the plate being interposed	8
	42

Light falling on a lens	100
Loss by reflection from two surfaces	16
	84

Thus we have, after reflection, 42 parts, and after refraction 84 parts; that is, half the area with the glass would be just as effectual with light as the whole would with a reflector; this would give five inches as the diameter of the glass, and seven inches that of the reflector, whereas by my experiment, $3\frac{2}{3}$ is the diameter of the glass when it is equally efficacious with the chemical rays as the reflector of seven inches. This would give nearly twice as great a loss of the chemical rays, by reflection, when compared with refraction, as there is of the luminous rays. If there is this difference between reflectors and refractors, there should be a much greater allowance than three-eighths for the loss from reflection from the flat speculum used with the lens. This would bring the aperture of the glass about equal to that of the reflector. I shall repeat the experiment more carefully when I have time; and if I am in error, will give you the result.

Yours, respectfully,

A. S. WOLCOTT.

James J. Mapes, Esq.

Extract from the leading article in the "American Repertory," New York, July, 1840, entitled "Remarks on the Daguerreotype,

by John W. Draper, M. D., Professor of Chemistry in the University of New York," page 403 :

"Before the paper of Mr. Towson, in the London and Edinburgh Journal of Science, had reached this country last November, I had determined the proper focus for the daguerreotype. In truth, every ray, except the yellow, leaves an impression on the iodine. Theoretically, therefore, it would seem that, in order to obtain perfect pictures, an achromatic lens is absolutely necessary. A more attentive consideration of the matter soon convinced me that lenses in which the chromatic abberration was uncorrected might be employed, provided care was taken to remove the plate from the camera at a certain period. For the impressions of light upon the retina are solely regulated by intensity ; but in the action of a decomposed beam on an iodized plate, *time* enters as an element. Suppose, therefore, a plate be exposed in the camera, during the space of five minutes, in light of a certain brilliancy, if the focus has been adjusted to the focus for blue light, a neat picture may be obtained ; for these being the rays in which the action is at a maximum, they *will have had time* to make a complete and perfect impression, whilst the red and violet rays *will not have had time* to give any perceptible effect. Upon these principles I found that very sharp pictures might be obtained, not merely by spectacle lenses an inch in diameter, but also by means of lenses of three or four inches aperture, such as have since come into common use. The first portrait I obtained last December was with a common spectacle glass, only an inch in diameter, arranged at the end of a cigar box.

"The risk of failure by employing an uncorrected lens is greater than the risk by a good achromatic or a reflector."

Flax Pulling Machine.

Mr. Tyler exhibited an ingenious model of a flax pulling machine, which he stated will pull five acres of flax in a day, thus enabling one man and a horse to do the work of twenty-five men. The machine costs less than one hundred dollars, and in Ohio, where flax fibre worth millions of dollars is lost every year, because the farmers cannot reap it economically, must be exceeedingly valuable.

Prof. Vanderweyde occupied the rest of the evening with remarks on Light and Sound, as the results of vibrations or undulations, after which the association adjourned.

AMERICAN INSTITUTE POLYTECHNIC ASSOCIATION,
April 11, 1867.

Prof. S. D. Tillman in the Chair; T. D. Stetson, Esq., Sec'y.

The Chairman presented the following notes on recent progress in science and art.

MAGNESIUM ALLOYS.

Mr. Parkinson of the London School of Mines, found most of such alloys made by him very brittle and easily acted on by air.

TO DETECT WOODY FIBER IN PAPER.

The paper is touched with ordinary strong nitric acid (*thalanit*). If wood fiber is present the paper will be colored brown, especially on warming. This reaction is more delicate than that with sulphate of aniline.

AN INK FOR GLASS.

M. Kessler, of France, has, by means of fluor-hydrate of ammonia (*olanaf*), and hydro-chloric acid (*thalad*), properly thickened, made an ink, by which, with any pen, ineffaceable characters can be traced on glass. This ink will be of service to the chemist and apothecary in labeling bottles, and marking graduations on glass.

ALUMINUM LEAF.

M. Degousse, a gold-beater in Paris, has prepared aluminium leaf weighing only .01544 of a grain per square inch, which burned with great brilliancy in the flame of a spirit lamp. In this form the affinity of aluminium for oxygen is said to be strong enough to decompose boiling water.

THE ATLANTIC CABLE.

This submarine cable is said to be often worked with great difficulty from daylight until two o'clock in the afternoon, after which the working grows easier and more rapid until dark. Through the night it is in the best condition. The same phenomena have been noticed on some land lines.

BLEACHING POWDERS.

Mr. Bolley has found that hypochlorite of magnesia (*magmedet*) bleaches much more rapidly than hypochlorite of lime (*calcmedet*), especially in the case of straw, for the latter compound first colors the straw brown, and then bleaches very slowly. The cause for

the difference in the action of these bodies is that magnesia is a weaker base, and parts with the chlorine more easily than lime.

Solvent for Fibers.

A solution of copper in ammonia is said to be a solvent for vegetable as well as animal fibers, such as wool and silk. It is capable of so penetrating one kind of fiber with a solution of another as to unite certain of their qualities; for example, enabling cotton to receive and retain the same dies with woolen, and with a similar tendency.

Astrolabe.

A very curious instrument for taking the altitude of the sun or stars at sea, made by the celebrated Arabian astronomer and mathematical engineer, Abdul-Aima, has been presented by the Minister of Public Instruction in Persia to M. Duruy, who has placed it among the collection of instruments in the Paris Observatory.

Berlin Ware.

According to Dingler's *Polytechnic Journal* this ware, highly valued by chemists, is composed of forty-five parts kaolin (a silicate of alumina), 37½ parts pure alumina, and 16½ parts felspar (a mixture of silica, alumina, and either potash or potash and soda). The enamel is composed of forty-two parts sand, thirty-three kaolin, thirteen unburned gypsum, and twelve of the baked composition first described.

Mountain Attraction.

The pendulum experiments now carried on in India in connection with the trigonometrical survey, under Lieut.-Col. Walker, have led to new and important conclusions regarding mountain attraction. Theoretically the force of gravity should be greater as the observing station approaches the Himalayas, but the reverse is found to be the fact. Col. Walker, in a communication to the Royal Society of London, says this seems a remarkable confirmation of the Astronomer Royal's opinion, that the strata of earth below mountains are less dense than the strata below plains and the bed of the sea.

Artificial Manure.

The manure made by M. Ville, and applied to the model farm of Napoleon near Vincennes, has the following composition and cost:

Slacked lime	200 kilos., cost	2 francs.
Phosphate of lime	400 kilos., cost	80 francs.
Nitrate of soda	500 kilos., cost	200 francs.
Carbonate of potash	200 kilos., cost	190 francs.
Total	1,300 kilos., cost	472 francs.

This quantity is required for one hectare, equal to 107,650 square feet, or nearly two and a half acres.

To Determine the Value of Glue.

Dr. Weidenbusch, after finding, by repeated experiments, that chemical determinations will not answer, devised a physical test, which consists in casting gypsum of the finest quality into sticks of mathematically exact dimensions by means of moulds of French chalk. These sticks are saturated with solutions of different glues, and one by one, placed in a brass ring having two deep notches to receive the stick; and connected, a lever and glass or iron beaker, into which mercury is poured until the stick breaks; thus the amount of mercury used is the measure of the strength of the glue. The author has not been able to ascertain any relation between the tenacity and the specific gravity of glue. Objection may be made to this method in consequence of the difficulty of obtaining sticks of exactly the same size and saturated by the same quantity of glue: nevertheless, the process is said to be more satisfactory than the common chemical process of precipitating gelatin by means of tannin.

The Arrest and Prevention of Cholera.

Dr. A. E. Samson, in a work with this title, advocates a curative treatment of the cholera, which depends on internal disinfection. He takes the ground that if antiseptics are found preferable to oxidizing agents applied externally, they should have the same relative advantage if given internally. We have two agents which fulfill the indications required, to render inert, an organized poison; 1. the sulphites; 2. carbolic (phenic) acid. These have their mutual advantages and disadvantages. The first is administered with greater facilities, but is more rapidly metamorphosed into other less efficacious compounds, and, no doubt, has less powerful action upon the germs. The second, on the other hand, has a "stinging" effect on the sensative surfaces, and its taste is to some

people disagreeable. Happily, having two agents, we can in a great measure neutralize the objections. The author prefers to use the sulphite of soda. He also gives one drop of phenic acid with three drops of chloroform in gum-water.

Cell Formation.

Dr. C. Montgomery has given to the Royal Society, account of some recent experiments bearing upon the chemical theory of cell formations. He seems to have gone some steps beyond Kirchow and Beneke in observing phenomena connected with myelin, a peculiar, fatty and viscid substance, resulting from the evaporation of the alcoholic extract of hard boiled eggs or of the brain, crystalline lense and other animal tissues. According to Beneke it is also found in the lower animal organizations and in plants. By mixing white of egg with myelin and water, Dr. Montgomery obtained globules having a lively molecular movement. A typical cell with nucleus and even with entoblast was present, and the white margin was visible which is so often mistaken for a cell wall. Globules were found enclosing a smaller globule, and sometimes more than one like the typical pus cell. Serum combined with a thin layer or myelin bi-conave discs, generally much larger than blood corpuscles, will be formed. The "cell" thus formed being the physical result of chemical changes, cannot, in the opinion of the author, any longer afford a last retreat to those of specific forces called vital, and physiology must embrace more than the study of the functions of a variety of ultimate organic units.

Respiratory Apparatus.

The London Chemical News states that the apparatus invented by M. Galibert, of Paris, has become very popular in France and England. Public experiments have been made with it at Paris, London, Southampton, Cherbourg, Toulon, Brest, and many other towns, and the success has been wonderful. Its object is to protect life from the dangers of an irrespirable medium, no matter what the nature; penetrating and thick smoke, nitrous, sulphurous, or carbonic acids; sulphuretted hydrogen, nitrogen, coal gases, &c. It is composed essentially of a reservoir of air, formed of a tissue, completely impenetrable, which the operator carries with him wherever he wishes to enter. At first the reservoir was formed of goat-skins, similar to those which serve in Italy, Spain, the South of France, &c., for containing wine or oil. These sacks, from the

great success of the apparatus, becoming rare and dear, Mr. Galibert was obliged to have recourse to cylinders of artificial tissue, perfectly impermeable and very strong, which he prepares by glueing together two strong linen and hemp cloths, each coated with eight layers of India rubber varnish. They are filled in a few seconds by means of a small bellows, and are capable of containing eighty litres (nearly 141 pints) of air. They are carried on the back of the operator like a knapsack, by means of straps. The communication between the air of the reservoir and the mouth and respiratory organs is made by two fixed tubes of India rubber, that of aspiration at the bottom of the reservoir, and that of expiration at the top of the bag, both tubes terminating in a sort of mouth-piece, which the operator places between his teeth. A strong clip prevents breathing by the nostrils, and the eyes are protected by two concave glasses set in a circular band of leather, which surrounds the head and shuts hermetically. Thus provided with air, the operator can penetrate and remain without suffering in the most mephytic and foul atmospheres. If his sojourn should be prolonged he can carry with him several cylinders for exchange, ready filled. He carries, also, suspended at his waist, an India rubber hollow ball or tube, which sounds on the hand being pressed against it, in case of danger. This apparatus has been adopted by the fire brigade of Paris and of many departments, by the general gas company, the navy, &c. It is absolutely indispensible for well-sinkers, sewerage workmen, repairers of gas-mains, and those who penetrate places in distilleries where fermentation is going on, as well as those in laboratories when noxious gases are generated.

Corrugated Iron.

Mr. Richard Montgomery exhibited several specimens of his corrugated iron. He compared the strength of ordinary sheets of iron with those of the same thickness which had been corrugated, and showed that the lateral resistance was greatly increassd by the process of corrugation.

Mr. Norman Wiard said a boiler made of this corrugated iron would be so stiff that it could not make one trip from here to Albany. It is the elasticity of boilers, like those of the St. John, that renders it possible for them to sustain the pressure they are subject to. By corrugating the boiler plates, they are made fifty times as stiff as the plain boiler. It is well known that metals

expand the same, nearly, at a comparatively low temperature, as at a higher heat. Mr. Stephenson, of this city, the omnibus builder, says that it is not necessary to heat the tires of wheels higher than a dull black heat, as they expand no more at a higher temperature. A boiler twenty feet long will expand three-eighths of an inch for every 180 degrees.

Dr. L. Bradley described, at some length, a new method of preventing the incrustation of boilers, by electricity, and making the boiler form part of the circuit between the positive and negative pole. This is a western invention, and it is said has been used with decided success on boilers in some of the western states.

Several gentlemen doubted the efficacy of this arrangement, as it was not clear by what chemical process the incrustation was prevented. It was stated that the plan would be put in practical operation in this city soon, and members would have an opportunity of witnessing it.

The following paper was then read by title:

Galvanic Batteries—Quantity and Intensity Currents.

Dr. L. Bradley.—I do not propose to speak of the elementary principles of the battery, or of the electro-dynamic force generated by it, but to confine myself to the consideration and promulgation of some of the discoveries I have been able to make, aided by the instruments heretofore described in my paper on the *Anthistometer*, and to the relative merits of such batteries as are employed in telegraphy.

Before proceeding further, I will explain what I understand by the words *quantity* and *intensity*, as they are commonly used in this branch of science. These words seem to me to be technical, and not to have reference so much to magnitude of any kind, as in the common acceptation of the terms, but to peculiar and distinct properties of currents.

I define *quantity* as that property of a current which gives it a great magnetising power, as well as great heating and decomposing power. It is the *desideratum* in all electrolytic pursuits, such as throwing down metals from their salts; in galvanizing, electrotyping, &c., but it is not capable of overcoming any great resistance, or of being propagated at any great distance. It is best obtained by large cups, having large plates, arranged as simple battery, *i. e.*, the positive poles connected, and the negative poles

connected so as to make them equivalent to our large cup, as in figure 1.

By *intensity* I mean that property which overcomes great resistance and renders the current efficacious in being propagated through long lines of telegraph wire, and in giving severe shocks physiologically. This is obtained by a large number of cups, which may be either large or small, arranged in *compound* battery, having the negative pole of one cup connected with the positive of the next, and so on as in figure 2. Small cups give equal intensity with large; hence, a cup formed of a gun cap, and charged with a lady's tear, was said to give impulses through the Atlantic cable, as strong as those from a cup of larger dimensions; but small cups do not last as long as large ones.

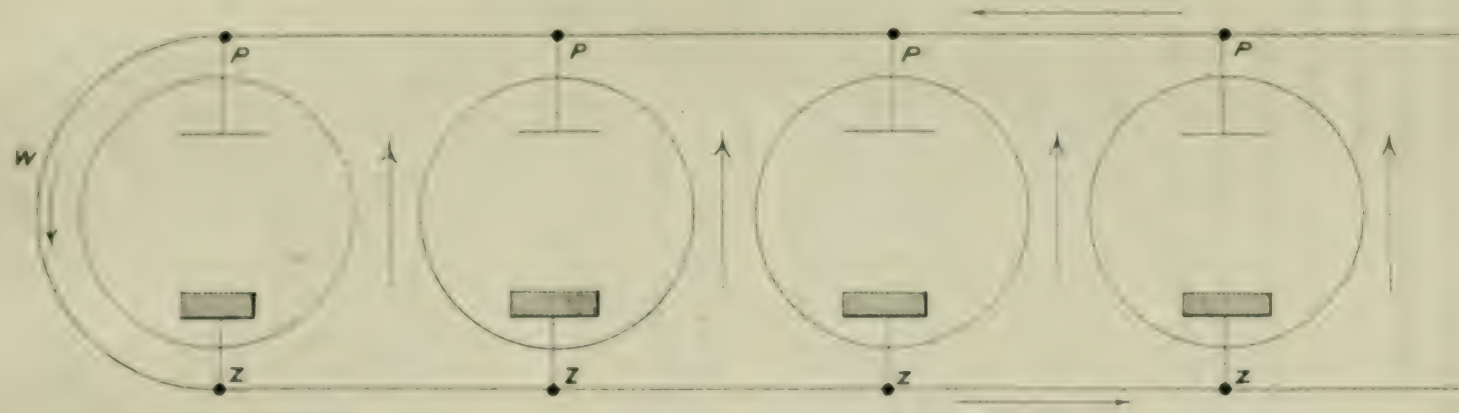
There is another property of a current, viz.: That which renders it capable of being subdivided, and of intensely charging and operating a number of long lines at the same time. This is obtained either by a large number of large cups, or a number of parallel series of smaller cups, arranged as compound battery, having the similar poles of the several series connected. A current possessing this property I have presumed to call *volume of intensity*. I do this with some diffidence, for I know that electricians have considered it a simple combination of *quantity* and *intensity*, and have not seemed to notice the distinction I am speaking of; but it seems to me that no portion of this current can exhibit the true properties of a quantity current.

There is certainly one plain distinction, *i. e.*, it does not possess the peculiar negative property of being incapable of overcoming resistance; for the whole or any subdivision of it is truly intense and is capable of overcoming great resistance, and of working a telegraph at great distances. It seems to me that the reinforcement of an intensity current, by the addition of another of the same quality, has the effect of increasing the *volume*, and not of converting it in any proper sense into a *quantity* current. It, therefore, seems to merit an appropriate name to distinguish it.

Theoretically, as stated by authors, the increasing of the number of cups in compound battery increases the intensity nearly in proportion to the number of cups, while the quantity is not increased. And, on the other hand, by increasing the number arranged in simple battery, the intensity is increased but little, while the quantity is increased nearly in proportion to the number of cups.

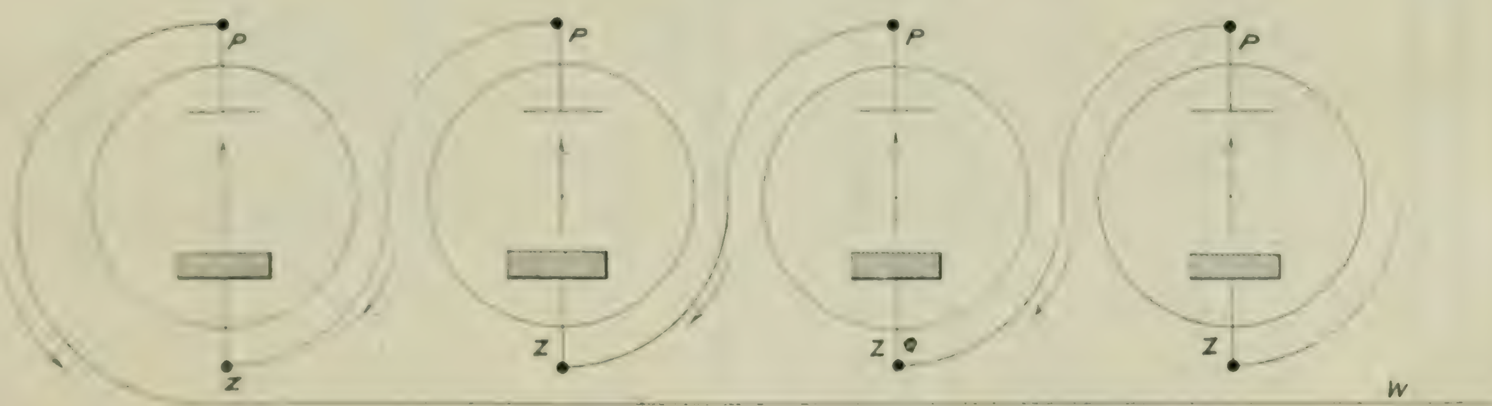
By testings made by myself, with four cups of Hill's battery,

Fig. 1



Simple, or Quantity Battery.

Fig. 2



Compound, or Intensity Battery.

See Page 924.

and my true tangent galvanometer, I have obtained the following results: The galvanometer coil for intensity is of fine wire, and gives 3.4 miles resistance; that for quantity is a simple plate of sheet copper whose resistance is so small that it need not be taken into account. The interior resistance of the cups is about 0.2 miles each.

First case:

Compound or intensity battery, with intensity galvanometer, and a rheostat resistance of 20 *miles.* (My unit of resistance is that of one mile No. 8 galvanized iron wire.) The deflection given

By one cup was	16°
By two cups	29° 15′
By three cups	38° 05′
By four cups	46° 45′

The increasing interior resistance prevents the forces from being quite proportional to the number of cups; for the tangents of these deflections show that the intensity of four cups, compared with that of one, is as 3.7 to 1.

Second case:

Compound battery, with quantity galvanometer and short, thick connecting wires. The deflection given

By one cup was	10° 30′
By two cups	10° 10′
By three cups	9° 40′
By four cups	9°

In this case we see that the quantity diminishes as we increase the number of cups, which is due to the increasing interior resistance; that for one cup being two-tenths mile, and that for four eight-tenths—showing how little capable, as stated above, a quantity current is of overcoming resistance. One hundred and twenty cups at the Western Union office gave deflection of only 5° 20′.

Third case:

Simple (or quantity) battery, with intensity galvanometer.—The deflections were as follows:

One cup	61°
Two cups	61° 40′
Three cups	62° 20′
Four cups	62° 50′

The increase of force in this case is due mostly to the proportionally diminishing resistance. In this arrangement the total interior resistance is not increased when we increase the number of cups. If a battery is composed of one cup, a given resistance is overcome by it; if the number is increased (the cups being equal), the same resistance is divided among them, and that shared by each is diminished as the number is increased.

Fourth case:

Simple battery, with quantity galvanometer, gave the following deflections, viz:

One cup	9°
Two cups	18° 40′
Three cups	26° 20′
Four cups	31° 40′

The cups individually gave the following deflections: 9°, 10° 40′, 11° 30′, and 10° 30′.

It is astonishing to observe how exceedingly sensitive this galvanometer is to the least possible amount of resistance, either interior or exterior. The extra wires necessary for connecting the several cups, produced appreciable effects, and changes in the relative position of the zinc and copper plates of one cup produced effects as follows, the deflections by the intensity galvanometer being at the same time noted:

Deflections.

Distance of plates apart.	Quantity gal.	Intensity gal.
One inch	32°	62° 45′
Two inch	25°	63°
Three inch	20°	62° 45′
Four inch	16° 10′	62° 30′

This shows how a large quantity is affected by resistance of any kind, and how very little intensity is affected by interior resistance.

I hope I have succeeded in giving some appreciable illustration of the two distinct properties, *quantity* and *intensity*.

The batteries most used in telegraphy are Smee's Sulphuric Acid Battery, Grove's Nitric Acid Battery, the Chromic Acid Battery, and some forms of the Sulphate of Copper Battery.

Smee's battery has gone nearly out of use, on account of the inconstancy of its current. When a circuit is first closed upon it, it starts off with great energy; but the counteracting effect of the

gas which accumulates upon the negative plate, causes it gradually to subside. I have seen the galvanometer needle fall back three or four degrees in the course of twenty minutes under the action of a cup of this battery. This difficulty, and its want of intensity, renders it unsatisfactory in telegraphing; but it gives great quantity, and in its electrolytic effects in throwing down metals and other chemical uses, it is of great value.

Grove's battery is too well known to require description. The theory of its chemical action is such as to make it more powerful for a given number of cups, in the combined properties of *quantity*, *intensity* and *volume of intensity*, than any other battery. But the enormous expense attending its use, together with the deleterious and corrosive fumes of nitrous acid, and nitric acid vapor, continually emanating from it, are highly objectionable. These difficulties are largely in consequence of local action. If we put a globule of mercury, or a piece of zinc, or of amalgamated zinc into a tumbler, and pour upon it a little diluted nitric acid, a violent effervescence takes place; the tumbler soon becomes too hot to be held by the naked hand, and the air is suffocatingly charged with nitrous acid fumes. This is precisely what takes place in every cup of Grove's battery, just in proportion to the quantity of nitric acid, which, by its tendency to diffusion, percolates through the porous cup; and this, I think, may account for the remarkable fact that this battery runs down nearly as fast when it works but one line as when it charges several lines. Showing that the consumption of material is due more to this local action than to that which generates the current.

The foregoing objections have caused this battery to go out of use in many places, and to give place to the

Chromic acid battery, which consists of the jar, the porous cup, the amalgamated zink, and the carbon of Bunsen's battery, and which, instead of nitric acid in the porous cup, is charged with Poggendorff's solution, which, according to De la Rive (vol. 2, p. 810), is composed of water, saturated with bichromate of potash and an equivalent of sulphuric acid. This liquid is so corrosive and oxydizing that it has been found almost impossible to make connections with the carbons that would serve any length of time, but A. S. Ogden, of Newark, N. J., and C. T. and J. N. Chester of N. Y., have lately contrived modes of connection which appear to be durable and safe. This liquid has the effect to saturate or fill up the carbons with *sesqui oxide of chromium*, which

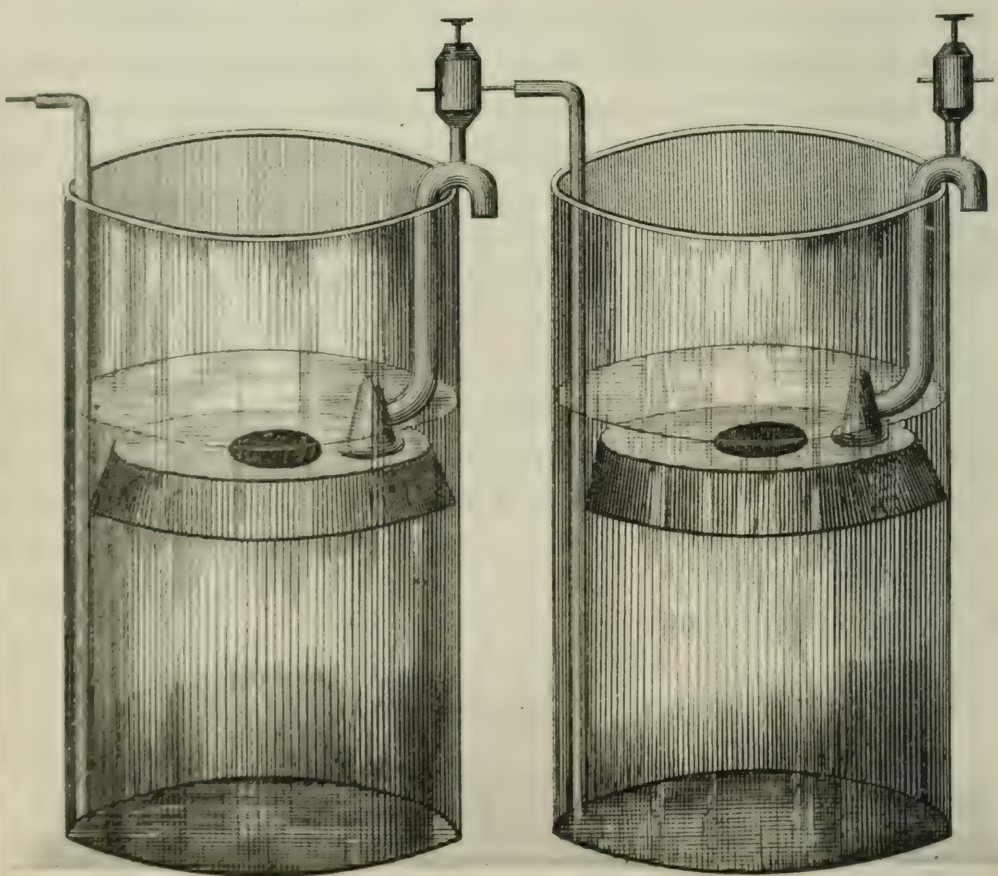
diminishes their conductivity, making it necessary, at intervals of fifteen or twenty days, to renew the battery and submit the carbons to thorough cleansing, by immersion in water for twenty-four hours or more. The bichromate solution has to be renewed every day for main circuits, and for locals, twice a day. This battery is properly called *chromic acid battery*, in contradistinction to the nitric acid batteries of Grove and Bunsen. Chromic acid is the active ingredient in the porous cup. The greater attraction of the sulphuric acid takes the potassa, and the chromic acid is set free, but the quantity is so limited (not more than one twenty-fifth part of its weight) that the battery can never be but short-lived and inconsistant.

The facility with which chromic acid parts with oxygen to form water with the hydrogen, which would otherwise appear in a free state at the negative plate, is such as to make this battery very powerful while it lasts, in both quantity and intensity. When we form connection by contract with a short ground wire, a brilliant flame of fire is elicited, which has been referred to, by respectable electricians, as a property highly meritorious. It *is* a valuable indication in a battery for electrolytic purposes, but in telegraphy it is the reverse. It indicates a kind of force, not only liable, under certain circumstances, to heat and destroy the magnet, but prone to escape at every possible opportunity. Everv particle of aqueous vapor that touches the telegraph wire, receives and carries off a full charge, and every cobweb, or other fibrous material that may chance to hang across the wire in a damp atmosphere, carries off a stream of the galvanic force. On the whole, it seems like a hard choice of evils to take this in place of Grove's battery; indeed, the objections to both are serious, and call loudly for something better.

In my numerous testings with both the chromic acid and nitric acid batteries, I have always been annoyed with irregularities in their action. I have set for hours to observe the perturbations of the needle under their action. When using the quantity galvanometer, I have observed the needle to vibrate, sometimes gently and steadily, and at others abruptly, to the distance of 4° or 5°, and have seen it moving back and forth over an arc of 10° or 12° in the course of an hour. These vibrations are not so large when I use the intensity galvanometer.

Daniels' sulphate of copper battery has always been emphatically pronounced "the constant battery," but it is not entirely constant, nor free from other objections.

HILL'S BATTERY.



See Page 929

The two plates and the porous partition between the two liquid elements being vertical, the sulphate of copper is first withdrawn from the upper part of the solution, requiring frequent agitation to restore the diffusion, which, for the time being, increases the strength considerably. The precipitated metallic copper attaches itself, in part, to the porous cup so firmly that it cannot be removed without being mixed largely with the particles of the cup, and, generally, spoiling it. This mixture deteriorates the metal and renders it unsalable, whereas, it would otherwise be pure and very valuable.

Hill's sulphate of copper battery has an arrangement of elements quite different from the above. The porous cup is dispensed with. The copper plate lies flat in the bottom of the jar, having a protected wire soldered to it, which comes up to the top for making the connection. A circular flat ring of zinc hangs in the top of the jar, by means of a hook screwed into its upper surface. The hook terminates at the top in a binding screw. No amalgamation of zinc is required. The jar is filled to a little above the zinc with a solution of sulphate of zinc (white vitriol) at about 20° Baumé, and two or three ounces of sulphate of copper (blue vitriol) is introduced so as to lie upon the copper plate. In a few minutes the copper plate is seen to be in a deep blue liquid, which is beautifully shaded off to white, in which is enveloped the zinc plate, and in taking care of the battery, this is the condition to be maintained. The copper solution being specifically heavier than the white liquid, it tends to remain at the bottom; the two plates, therefore, are each maintained in its proper element, without the interposition of a porous diaphragm. As occasion requires (according to the work performed), a little blue vitriol is added, and as the upper liquid grows stronger, a little is drawn off and the jar replenished with water. Not oftener than once a week is any attention required; once in three or four weeks the zincs should be cleaned off, which may be done without disturbing the working of the battery by cutting out three or four cups at a time in the usual manner. This is, without question, the most constant and reliable, and by far the most economical battery for telegraphic purposes of any that has ever been used.

As to the cost of material actually consumed in running these several batteries, I have some data which is deemed reliable, from which I select cases where the batteries performed about equal

service in running two long lines each, which give the following results, viz.: Grove's battery, per cup per month, \$1.09; Chromic acid battery, per cup per month, 31¼c. to 35c.; Hill's battery, per cup per month, 4c. to 5c. Now, we may concede that ten cups of this battery are required to perform what might be done with four of either of the others; we see that economy is greatly in its favor, for then the monthly expense is not more than one-third that of the chromic acid, nor more than one-eighth that of Grove's. Such results seem almost incredible, and yet the following gives a record still more favorable for Hill's battery:

I erected a series of 120 cups, which we put in operation at the Western Union Office in New York, on the 23d of November last, on one printing wire and one Morse wire to Boston. It has been running constantly to the present time. During the first month, thirty pounds blue vitriol were supplied, and on the 23d instant (four months), ninety pounds only had been consumed, of which the equivalent of zinc is about 23½ pounds; but the zinc need not be taken into the account, for the precipitated copper, being pure, will sell for enough to offset the cost of all material consumed except the blue vitriol. The ninety pounds of blue vitriol, at eleven cents per pound (the present cost by the quantity), is \$9.90, or \$1.24 per line per month, or a very small fraction over two cents per cup per month for the two lines. This record was kept and can be verified at the Western Union Office. The current was admitted to be constant, smooth and satisfactory.

I have experimented much in ascertaining the interior resistance of the various batteries. I do this directly by the method heretofore described in my paper on the *Anthistometer;* also, by equations.

By Olms' law,

$$\frac{e}{r} = s, \text{ and } \frac{e}{r + r'} = s'$$

In which e = electro motive force; r = interior resistance; r' = exterior, inserted resistance; s = strength of current in circulation; s' = strength when r' is inserted.

By eliminating e and reducing the equation, we have

$$r = \frac{r' s'}{s - s'}$$

For simple battery of one cup or more, I use the quantity gal-

vanometer, and note the deflection which the battery gives. I then insert some known resistance (r'), say a wire or coil of 0.2 miles, and note the reduced deflection. The tangents of these two deflections give s and s'. We have, then, the known quantities r', s, and s' from which, by the formula, we compute r, the interior resistance. The results obtained by the two methods agree almost perfectly.

For compound battery, I use the intensity galvanometer, and insert some larger known resistance (r'), as a mile, or ten miles; or more, according to the length of the series. Let the resistance of the galvanometer coil be represented by g, and the formula will be,

$$\frac{e}{g + r} = s, \text{ and } \frac{e}{g + r + r'} = s'$$

in which g, r', s, and s' are known quantities.

The interior resistance of the nitric acid and chromic acid batteries, under different circumstances, I have found as follows, the circuit being kept closed on a local sounder, which gives 0.3 mile resistance: One cup Grove's battery (new), $r = 0.047$ mile; same after running 8 hours, $r = 0.068$ mile; same after running 16 hours, $r = 0.140$ mile; one cup chromic acid battery (new), $r = 0.027$ mile; same at 6 hours, $r = 0.062$ mile; same at 16 hours (about run down), $r = 0.154$ mile. With Hill's battery, r ranges from one to two-tenths mile, according to the size and proportions of the cup, at all times. The resistance of the same cup scarcely varies two hundredths of a mile from month to month.

The r is a very good index to the constancy and durability of the several batteries.

The following paper was read by the translator:

The Cotton Seed Oil.

Its Physical and Chemical Properties.

[Translated from Jacobson's Repertorium by Dr. Adolf Ott.]

If cotton seed is pounded and then heated to 167° to 181° F., it yields, by pressing, 15 to 18 per cent of a dark brown colored oil, containing more or less slime and albumen in suspension and, perhaps, a portion in solution. It is 28 to 30 times less liquid than water, and its specific gravity is not always the same. Adriani found it to be 0.93074 at 53.5° F., from a middle proof of 24 barrels; another proof he found to have the specific gravity of

0.93169 at 58° F. A part of the latter treated with steam of 280° F., and carefully washed with boiling water, whereby most of the suspended vegetable impurities are separated, showed at 50° F., the specific weight of 0.93433. This latter approximates very closely that of the linseed oil, which, except in color, is very similar to the cotton seed oil. The latter is a siccative oil, and in many instances is a good substitute for the former. It is readily soluble in ether, sulphide of carbon and benzol, but not so in alcohol, even when heated; however, alcohol dissolves that part of the substance from which the crude oil derives its color. This color is not produced by the husks, because they do scarcely give any soluble substance neither to ether, alcohol, sulphide of carbon, nor to water; but it is produced by small black flaculæ, which are floating in the yellowish white liquid, and are easily recognized by the unassisted eye. Under the microscope they appear filled with a resinous fatty body of a dark rose color, which is soluble in alcohol and ether, and (under simultaneous decomposition) in weak solutions of caustic alkalies. If the seed kernels are pounded in a mortar, they yield a dark reddish-brown liquid. The original matter is originally of a yellowish green color, and may be so extracted by heating with alcohol under an exhausted receiver of an air pump and evaporating in a vacuum. Digestion in the presence of the atmosphere yields the dark color as stated, which is evidently the result of oxydation of the coloring matter of the oil, but neither mordanized cotton nor woolen can be dyed with it.

Treated with re-agents, the crude oil behaves very peculiarly; concentrated oil of vitriol produces a beautiful purple color, which by stirring becomes darker; after 24 hours the mixture is very thick and of a reddish brown tint, sulphurous acid is developed and the color becomes of a dark blood red; after leaving it again for 24 hours, it becomes a solid blackish mass. Adding strong nitric acid, the oil becomes first of a dark olive green, but soon light orange red; after 24 hours it is solid and shows a dark orange red color. By mixing the oil with a solution of potassa of 1.22 specific gravity, the liquid is first yellowish, then, on stirring with a glass rod, those parts in the test tube which are most exposed to the air take a bluish purple color, similar to that of a solution of pyrogallic acid in potassa, when exposed to the air; after 24 hours the oil is getting solid; the same result is obtained by soda lye. By adding strong liquor of ammonia, a yellowish green color is produced; strong phosphorous acid shaked with the oil

does not produce any change in the beginning, but after 24 hours it thickens and changes to a dark olive green. By adding lime water, the oil solidifies at once and takes a dirty, brownish yellow color. Sulphurous acid gas, when passed through it does not decolorize it, nor do the chlorides of zinc and tin, nor the acetate of lead, produce any remarkable change. In its oxydized state, and probably also under the influence of the vegetable matter contained in the oil, the coloring pigment seems to be very much inclined to cake together to a fatty mass. As concerns the crude oil, it solidifies between 28° and 26.5° F.; it is very well adapted for preparing hard and soft soaps and is a good substitute for linseed oil in dark paints, varnishes, and, perhaps, also in printing ink. The so-called refined oil, of which the best quality, as regards odor and taste, is very similar to olive oil, solidifies between 28 and 32° F Its specific gravity is 0.92647, at 60.5° F. it is 1.7 times less limpid than water. Properly speaking, it is more or less pure olein. In Italy, where the cotton culture has recently been introduced, it is used as a burning fluid, and not seldom as an admixture to clearer oils. One hundred pounds of crude oil yields 290 pounds soft soap, containing 52.65 per cent of water, and 170 pounds of hard soap, of a water amount of 38 per cent. Lead plaster was obtained by direct saponification of the oil with oxide of lead, as well as by double decomposition of both, by precipitating a solution of soap with acetate of lead ; 100 potash soap yielded 57 dry lead soap. The dark color of the oil is visible in all these soaps, but least in the soda soap. The refining of the oil, *i. e.*, the separation of the coloring matter and the obtaining of a better article, can simply be done by washing it with potash or soda lye, but it is good to separate first the slimy and albuminous matter by the introduction of steam, and washing with boiling water. By the action of the alkali, not only the dark pigment is solved, but also a part of the oil is saponified. In leaving it at repose, the mixture of the oil and alkaline settles into three different layers, of which the top one forms the colorless refined oil, while the dark colored middle one forms the saponified fat, and the dark at the bottom, the black alkaline lye. Steamed oil treated with oil yields, under favorable conditions, 85-88 per cent. of refined oil. It is said that very great quantities of it are employed for adulterating the olive oil. Pols has patented the following method for refining cotton seed oil : One hundred parts of the crude oil are mixed with 12 parts of a solution of 42°

Baumé, consisting of 100 gallons for a boiling solution ; of potassa, of 42° B., five gallons ; solution of tartaric acid of 42° B., and lime milk of 10° B. This solution is added to the hot oil, the whole stirred for 24 hours, and left at repose for 24 hours, whereupon the oil has lost its dark color, and may be filtered. The residue resulting from this process is boiled for two hours with one-tenth its bulk of strong salt water ; hereby yet some oil will raise to the top, the remainder solidifies in the cold, and may be made into soap.

Adjourned.

American Institute Polytechnic Association, April 18, 1867.

Prof. S. D. Tillman in the Chair; T. D. Stetson, Esq., Sec'y.

The meeting was opened by the Chairman with the following notes on new discoveries and inventions:

Beef Preserved Forty Years.

Some beef deposited in tin cans, beneath a heap of stones, in Spitzbergen, by Capt. Parry, in 1827, was recently discovered, and a portion was cooked and eaten at a supper given in Stockholm, Sweden.

Absolute Cold.

The temperature of the ethereal medium is not higher than 275° C below the melting point of ice; that is—463 on Fahrenheit's scale. Person, in calculating the heat absorbed by different bodies during fusion used the constant 256° F., and inferred that this number of degrees below zero was the point of absolute cold; yet, Natterer has produced, artificially, cold expressed by—220° Fahrenheit.

Steam Plowing in Great Britain.

According to a report made to the Royal Agricultural Society, 230,000 acres of arable land are now prepared for crops by 400 steam-plows and cultivators, which have displaced 2,500 horses. As the steam engine only eats while it works, a great saving is effected. Nearly all these plows are driven by small stationary engines which are transported from field to field; the plows are fastened to an iron or steel wire rope, which is drawn from one side of the field to the other by means of a clipped drum connected with the engine.

Expansion Due to the Galvanic Current.

Mr. E. Edlund, of the Swedish Academy, has made a series of experiments with conductors of a galvanic current to ascertain whether the expansion they undergo is simply the result of their increased temperature, or whether it is greater. He invariably found the expansion of his conductors (platinum, iron and brass) was greater than would be produced by the actual heating of these metals to the temperature indicated. This increased effect he proposes to call galvanic expansion, to distinguish it from calorific expansion. The galvanic expansion increased rapidly with the intensity of the current; but the ratio of expansion and intensity he has not yet determined.

Oreide.

This alloy, resembling gold in color, is now manufactured at Waterbury, Conn., by mixing pure copper, 100 parts; zinc or (preferably) tin, 17 parts; magnesia, 6 parts; sal ammonia, 3-6 parts; quicklime, $\frac{1}{8}$ parts; tartar of commerce, 9 parts. The copper is first melted, then the lime, magnesia, sal ammoniac and tartar are added, little at a time, and the whole is briskly stirred for about a half an hour so as to thoroughly mix the whole; then the zinc or tin is added in small grains, and the mixing process is continued. Finally the crucible is covered and the fusion is kept up for about thirty-five minutes. After the dross is skimmed off the brass is ready for use. It is quite malleable and ductile, being distinguishable from gold only by its inferior weight.

A New Glowworm.

William Perkins, Esq., of the Royal Geographical Society of London, writes from Rosario, Argentine Republic, that in the Grand Chaco, he had found the most extraordinary elateride ever heard of. It is a most brilliant glowworm, one inch and a half long, with two fires. The body emits a most vivid light, of the ordinary greenish phosphorescent color, while the head presents the appearance of a bright, glowing, red, coal of fire. The reflection on a piece of paper is also of two colors. He had never seen anything so beautiful. Mr. Bollaert, a member of the same society, says this is, doubtless, one of the cocuyos family. He had noticed glowworms in the West Indies, North and South America, but never in such abundance and beauty as in the wilds of Western Texas; still, he never observed but one light, the green.

Sensitive Flames.

The jumping of a naked fish-tail gas flame, in response to musical sounds, was first accidentally observed by Prof. Lecompte, of South Carolina, at a musical party. At a lecture on the subject, lately delivered at the Royal Institution at Great Britain, Prof. Tyndall exhibited some extraordinary experiments. He showed a flame twenty inches long, which was knocked down to eight by a very slight tap on a distant anvil. At a distance of twenty yards the dropping a sixpence from the height of a couple of inches into his hand containing a few coins brought the flames down. It was sensibly influenced by the creaking of boots in walking across the floor. On speaking to the flame it jumped at intervals, apparently picking certain sounds from the utterance, to which it could respond, while it was unaffected by others.

A New Psychrometer.

M. Bequerel has found a new use for thermo-electric bars; his modification being intended to take the place of a hygrometer, composed of a wet and a dry bulb thermometer. His thermo-electric circuit consists of an iron and a copper wire of a diameter dependent upon their length; the longer they are the greater the diameter. Within this circuit is a galvanometer intended to show when the temperature is the same at both points where the metals have been soldered together. One of these points is placed in a medium, the temperature of which is lowered until the needle indicates zero. The second point having attained the same temperature is placed in the medium contained in the aqueous vapor, the elastic force of which is to be determined. With the instrument he claims to have determined the difference between the elastic force of aqueous vapor just above the surface of a river, and at a point three meters higher.

Water-Glass on Wooden Floors.

A Hamburg paper strongly recommends soluble glass (silicate of soda) as a coating for floors. Before applying the coating the floor should be well cleansed and the spaces between the boards be filled with a mixture of silicate and chalk, or gypsum made into a thick dough, which quickly sets into a hard mass. The floor may then be brushed over with a solution of silicate. If colors are employed, most vegetable pigments must be avoided, because of the alkali in the solution. The mineral colors used

should be ground with equal parts of water and skimmed milk before they are mixed with the soluble glass. It is applied with a stiff brush, and as it dries quickly, a second coating may be put on in half an hour. It is said a brilliant polish is secured by finishing with a coating of oil. This process protects the wood and renders it almost fire-proof, and when colors are used is highly ornamental. It is reported to be well adapted for stores, offices, and public buildings.

A Complex Clock.

The Paris Exposition contains a fine piece of mechanism from the Silesian Capital, Breslau, made by Herr E. Sholz. The clock shows on a large dial-plate, artistically decorated, the time of Breslau, and on a smaller plate immediately underneath, the Berlin time, with seconds' stroke. On the back of the case, which is made of gray marble, and before which the pendulum swings, are on the right and left two vertical rows, each of twelve dial-plates, showing the corresponding time of twenty-four of the most important towns of the world, viz.: Pekin, Sydney, Calcutta, Moscow, St. Petersburg, Constantinople, Rome, Paris, Marseilles, London, New York, Washington, San Francisco, &c. On each of these dials the minute hands move all at once, a minute on, after the lapse of a minute. Under the dials, and over a mirror, a nicely finished globe revolves once in twenty-four hours. The weights moving the whole clockwork are curiously arranged, and are connected with an almanac giving the month, day of the week, and date. The pendulum is made to serve the purpose of a thermometer, and connected with it is a metallic barometer. This clock is one of the most complete ever constructed, and has been admired by scholars as a real work of genius.

Coral-Lignin.

This is the name given to a new artificial substance by the inventor. It is said various articles of the new manufacture will be shown in the Paris exposition. The material is made by macerating potatoes, turnips and carrots in water containing about eight per cent of sulphuric acid for 24 or 36 hours. The acid is then washed out by repeated applications of fresh water; this must be continued until the center of the vegetable will not redden litmus paper. When potatoes are used, it will be found that considerable disorganization has taken place; they are whiter and soft. They

must then be wrapped in blotting paper and carefully laid under warm sand, or upon chalk or gypsum. When dry, the potatoes will be found to have shrunk to about one-half their original volume, and in external appearance they will exactly resemble meerschaum. By treating the macerated potatoes with caustic soda, the starch and cellular tissues are made to unite and form a substance resembling horn. Turnips may also be similarly treated, so as to resemble stag's horns. Thin slices may be used as veneers and soaked in glycerine and water they become flexible as leather. Carrots thus treated resemble coral, and may be used for handles of knives, umbrellas and whips.

Pins and Eyes.

The London Engineering, in an article upon this subject, says that in all cases, but more particularly in bridge work, it is important that the size of the pins and eyes should be so proportioned to the strain upon them that they will be of equal strength with the parts which they connect. In machinery, when the parts are subjected to motion, sufficient bearing surface has to be provided to prevent heating, and it is generally this consideration which governs the size of the parts, those proportions which give the requisite bearing surface being generally amply sufficient as far as mere strength goes. After giving the results of experiments tried to determine the proper proportions of the eyes of the links and the connecting pins of the iron suspension bridge over the river Dnieper at Kieff, the chains of which weighed over 1,600 tons, and stating the proportions recommended by Sir Charles Fox and Professor Rankine the *Engineering* expresses the opinion that when circumstances will allow its being done, the best way to obtain the requisite bearing surface for the pins of connecting links of small thickness in proportion to their section, is to increase the thickness of the eyes beyond that of the links themselves. This allows the metal around the eye to be made narrower, and it thus consequently diminishes the inequality of the strain throughout its section. Where the links are to be connected by a square section, or are of considerable thickness in proportion to their area, this thickening of the eye becomes unnecessary, as sufficient bearing surface is given without it. A rule for the size of eyes, which has been much used, and which gives generally good results, is to make the outside diameter of the eye equal to twice the diameter of the pin passed through it, and then to increase the thickness until the requisite section area is obtained.

Fire-proof Wood.

Dr. Feuchtwanger stated that a very good fire proof wood could be made by soaking the wood in lime water and then coating it with silicate of soda.

New Iron.

Col. Edwin Henry exhibited a specimen of iron from Green county, near Greenville, Tennessee, manufactured by the New York and East Tennessee Iron Company. It contains seven per cent of manganese. This is what the Germans would call spikeleisen. With three per cent of railroad scrap and the rest of this iron a very good metal can be made. No iron ore like this, containing manganese, has been found in this country except the deposit of the N. J. Franklinite. It differs from the latter in containing no traces of zinc.

Water Meter.

Mr. James Cochran exhibited his water meter, and put it in practical operation. The water is discharged into a tilting pan which is emptied as soon as full, and each motion of the pan moves an index so that the actual quantity is measured. The inventor claims that by an improvement lately made the water passing through his meter is properly aërated before it is delivered.

Submarine Cables.

Samuel C. Bishop presented a paper on the art of telegraph insulation and on submarine cables insulated with gutta percha. He also exhibited a sample of pure gutta percha insulated wire, being a piece of one of the earliest submarine cables ever made in the world, and which was laid across the North river in 1849, and this piece taken up from the shore under ground, in 1858. When taken up was in a perfectly sound condition. It is now (eight years after) cracked on outside from being exposed to the atmosphere only. Many other submarine wires had been taken up and examined by Mr. Bishop during an experience of eighteen years, and he stated that in every case the gutta percha was found to be sound and perfect. He also exhibited a piece of pipe made in 1851 (at the works under his charge) which was laid across the East river to convey the Croton water to Blackwell's Island. This piece was cut out when the pipe was taken up for repairs, and relaid in 1866, and is now as perfect as when made fifteen years ago. He also exhibited a piece of submarine cable passed through an iron weight with a hard pine wedge, to keep the wire in place,

which had been under salt water, in Muskegat channel, five years. The teredo had eaten the pine wedge, but the gutta percha was uninjured; showing that this most destructive sea-worm, which destroys ship's bottoms, timber, and everything in its way, will not eat gutta percha. All experience shows fully, the perfect indistructability of gutta percha under water, and even under ground, when properly laid and protected from the action of the sun, heat and atmospheric changes. Speaking of telegraphing across the ocean, on page 487 of American Institute Transactions for 1864, Dr. R. P. Stevens says: "At the present time the ocean contains salts of copper and acids that will affect the metal covering of the wire, and the vegetable matter, such as the hemp and gutta percha, used in its construction, must sooner or later be destroyed." Experience has since shown that gutta percha will not decay under water. Mr. B. P. Finnell, see page 488, same book, exhibited a piece of the first Atlantic cable from on board steamship "*Niagara*," and since kept in a damp place, the gutta percha was found to be shrunk half an inch in the piece eight inches long; and the effects of this on a cable of some miles in length was obvious."

In answer to these statements, Mr. Bishop exhibited two pieces of submarine cable made by him about four years ago, which have been exposed to the atmosphere ever since. One of these, about twelve inches long, is shrunk about one-quarter of an inch on each end, where it was exposed; but the other piece, about ten inches long, which was varnished on the ends where the gutta percha was exposed, was not shrunk at all, showing that it is only where the atmosphere attacks gutta percha that it shrinks; and that in a cable protected by a hemp and tar bedding, where the atmosphere is entirely excluded, there cannot be any shrinkage or injury to the insulation, and if under water beside, it is beyond the reach of harm.

The following may not be uninteresting in this connection:

The history of Prof. Morse's experiments and their result, the grandest and most wonderful discovery in the arts of modern times, need not be here recapitulated. The discovery of some efficient and practical non-conductor to shield the wire from contact with other conducting substances, and prevent the escape from it of the electric fluid on its way to its destined point, now became a desideratum of the highest, and indeed of vital importance to the success of telegraphic lines, whether aerial, submarine or subter-

ranean. Experiments with various non-conducting substances were extensively made, but with respect to submarine and subterranean lines, without any satisfactory practicable result with any of them, except gutta percha. A brief notice of this valuable substance is here given.

Gutta Percha

Is the Malagan term given to a concrete juice taken from the *Isonandia* or *gutta* tree, indigenous to all the islands of the East Indian Archipelago. The juice consolidates quickly after it is collected, forming a compact mass, in hardness somewhat similar to wood.

Gutta percha is one of the best of the non-conductors of electricity, while its adaptability as a covering for submarine and subterranean telegraph wire as an insulator, is unrivalled. It is not injured by coming in contact with oil or other fatty substances. It resists the action of sulphuric, muriatic, and nearly all the other acids.

In the above properties it is the opposite of India rubber. Gutta percha has an exceedingly fine grain, and its oily property makes it perfectly impervious to liquids. When exposed to the action of boiling water it becomes soft like dough or paste, and may then be moulded or worked to any shape, which shape it will retain when cold.

It will be observed that in the foregoing remarks on gutta percha as an insulator, reference is made only to submarine and subterranean lines. For these from its imperviousness to moisture, its strength, durability and excellent power of protecting the wire, it has assumed the supremacy over all other substances now known.

This substance was discovered by Dr. Montgomerie, at Singapore, in 1822. The first importation of gutta percha into Europe as an article of commerce, was to England, in 1842. Its first importation into America was in 1847, by Wm. S. Wetmore, for Samuel T. Armstrong, to manufacture.

In its hard condition gutta percha is easily softened by heat, and soluble by chloroform, &c. Many efforts were made to adapt it in solution to the purpose of telegraphic insulation, but without practical success. All the patents taken out for this purpose were consequently valueless, until, in England, a method was devised which was completely successful. Availing himself of the sus-

ceptibility of gutta percha to be softened by heat and rendered plastic and easily worked by immersion in hot water, Richard Archibald Brooman, in the year 1845, secured letters patent for a method of preparing it for use in the arts. Covering everything into which gutta percha could be manufactured, this patent was called the "Master patent." It only now remained to discover some effectual method of applying the gutta percha thus prepared, to the covering of the telegraph wire.

In September, 1845, Henry Bewley took out letters patent, in England, for a machine for making *tubes*, *flexible syringes*, *bottles*, *hose*, and other like vehicles or vessels, or to the improvement thereof, &c.

Hancock and Keene also took out letters patent, in England, about the same time, for processes of purifying and working gutta percha, &c. (Vide the "Magazine of Science and Arts," 1846.) Brooman and Bewley sold their patents to the London gutta percha company, who, under them, made the Atlantic telegraph cable.

The present process of making lead pipe of indefinite length, by machinery, is in principle similar to that for forming gutta percha pipe.

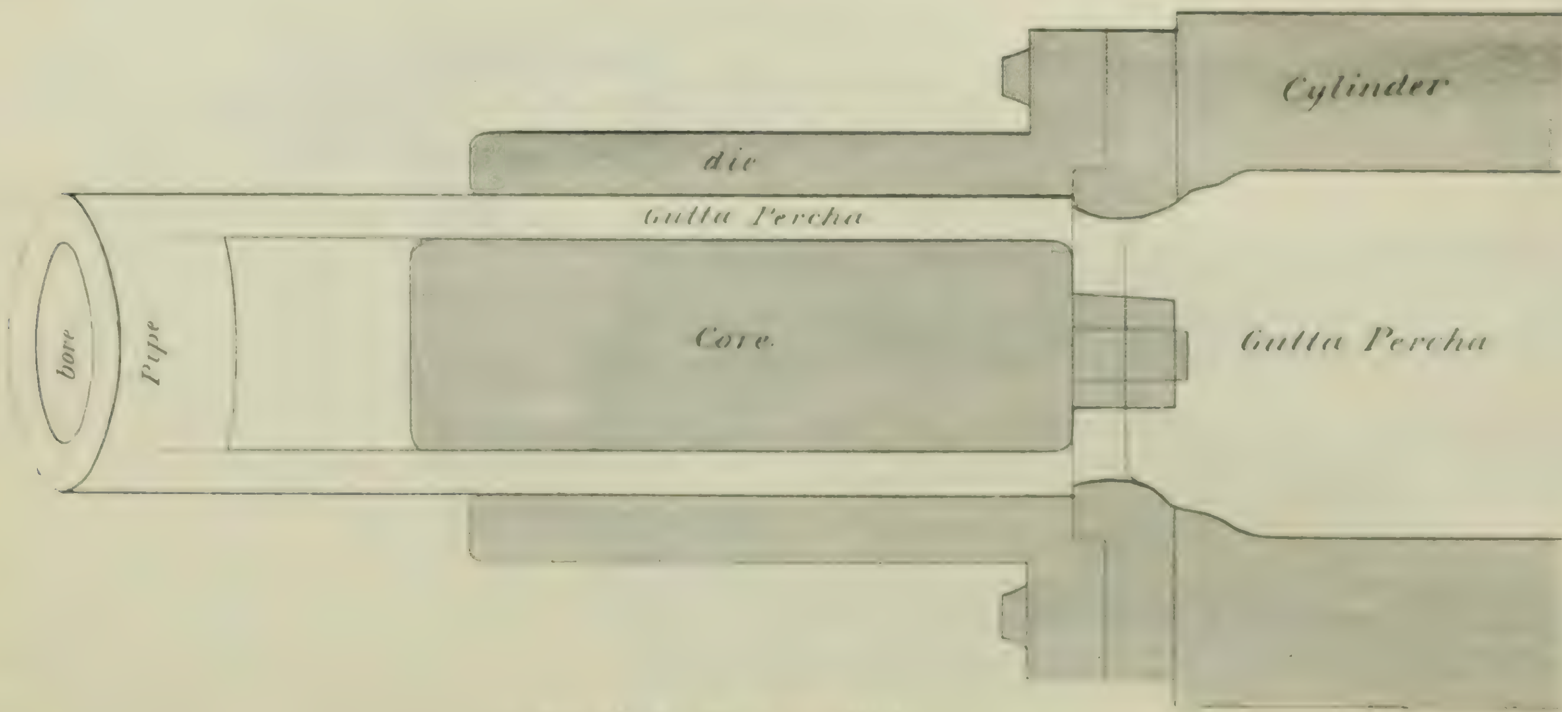
The Bishop Gutta Percha Company of New York use the same machinery, and by it have made all the telegraph cable used by the Government of the United States, and nearly, if not quite all, that has been laid by the telegraph companies in this country. The annexed drawings gives a view of this machine, and its manner of working.

The process of making pipe is through a die, with a mandrel or core attached to the head of the machine, at the point where the formation commences. The process of covering wire is through two dies, with the wire in the centre, which is carried along with the gutta percha, thus forming the coating; the same cylinders are used in both cases, and no change except the wire instead of the mandrel, and two dies in covering wire, and one in making pipe.

First Use of Gutta Percha as a Cable Insulator.

Pierrer's Universal Lexicon, 17th vol., page 339, has the following: "In 1846 the Prussian Lieutenant, Siemens, tried first to cover telegraphic wire with gutta percha, and in 1847 laid down three hundred German miles; but they soon ceased to work well

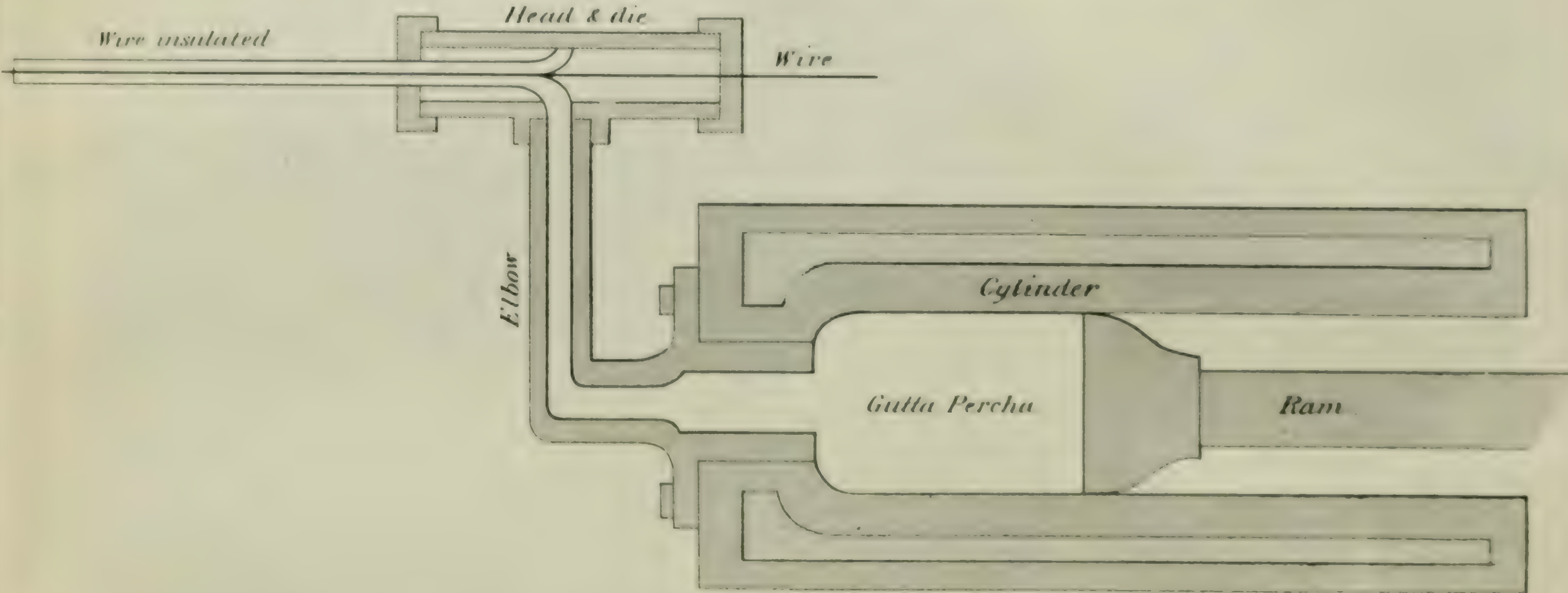
MACHINE FOR MAKING PIPE.



½ of Cylinder Ram omitted here to show Gutta Percha.

See Page 942

MACHINE FOR COVERING WIRE WITH GUTTA PERCHA.



See Page 942

on account of the sulphur mixed with the gutta percha. A mile of this wire cost eight hundred Prussian thalers."

In 1847, Samuel T. Armstrong went to London and purchased the right to use the four English patents (Bewley's Brooman's, Hancock's and Keene's,) in the United States, and had them registered by our Patent Office, at a heavy expense.

In 1847, Samuel T. Armstrong with Lorenzo Higins, made the first telegraph wire covered with gutta percha in this country, by a machine on a similar principle but not identical with that now used. This was a single cable made for the Magnetic Telegraph Company to cross the North river. It was No. 9 iron wire with half an inch in diameter of gutta percha over it.

Thomas M. Clark and John W. Norton, both of New York city, laid this cable. It was the first sub-marine cable insulated with pure gutta percha ever made in the world. Mr. Armstrong continued to manufacture until 1851. At that time Mr. S. C. Bishop joined Mr. Armstrong, and afterwards carried on the business alone. In January, 1862, the Bishop Gutta Percha Company was formed of which Mr. Bishop is manager. The company have increased their facilities for manufacturing sub-marine and other cables, as well as a great variety of useful articles made from gutta percha. Their works are at Nos. 208, 210, 212 East 25th street, near the East river, where vessels can easily be loaded with cables directly from the manufactory. All sub-marine cables used in the United States were made by this company, and are now working satisfactorily.

The Chairman read, by title, the following address at the University convocation for 1866, by one of the most distinguished savans in the country, for the purpose of inserting a large part of it in the proceedings of the Association. The sound views inculcated therein, bear upon the same points to which the Chair had, several years ago, directed attention, and being from the head of one of our leading universities, the hope was expressed that they would lead to a wholesome reform, and be the means of imparting to every college graduate such practical knowledge as will be of daily use in his intercourse with those who are now engaged in the development of the material resources of this continent.

ON THE STUDIES PROPER TO BE PURSUED PREPARATORY TO ADMISSION TO COLLEGE. BY FREDERICK A. P. BARNARD, LL. D., PRESIDENT OF COLUMBIA COLLEGE.

Whenever it happens that any subject interesting to man becomes matter of protracted controversy, the zeal of opposing parties often carries them so far as to make both of them equally intolerant of one who is not wholly with themselves, though at the same time he may be by no means with their adversaries. The task, therefore, of one who undertakes to show—what is usually true—that to a certain extent both parties are in the right, while neither is wholly so, is by no means an easy one. He is very likely to incur the disapproval of both, while he is not sure to conciliate the favor of either.

This consideration embarrasses me in the attempt I am about to make, to exhibit certain views connected with our system of higher education, founded upon convictions which have long been gradually growing upon me, but which I apprehend are not likely to be in full accordance with those of any considerable number of the experienced educators whom I have the pleasure of addressing.

In the discussions which have taken place in our time with respect to the merits of our system of collegiate education, the field has been occupied almost exclusively by two parties holding opinions widely discordant; so much so indeed as hardly to admit of any description of compromise. One of these parties, which may properly be styled the conservative, has made classical learning its watchword, and has steadily resisted the encroachments upon our time honored course, of modern science in all its branches. It has regarded every slight recognition which has been made of the value of this knowledge, as an unwise concession to popular clamor, and a wrong done to the cause of education; and has maintained, or if it spoke its full thought would doubtless maintain, that the collegiate education of this country was vastly better at the close of the eighteenth century than it is now, in the middle of the nineteenth. The other, which styles itself the progressive, and is styled by its opponents the destructive party, denounces with contempt a system which rests, as it asserts, upon a literature and a history which have long since ceased to have any living interest for the human race; and occupies itself with the painful study of languages which exist only as literary curiosities, and which will never more be either spoken or written; while shutting its eyes to the condition of the living world of to-day, it

treats as unworthy of notice the great discoveries which in recent times have revolutionized the aspect of society, and transformed the whole surface of the planet, is indifferent to the great lessons of political and social science to be drawn from the fruitful pages of modern history, and finally flings its *élèves* into the midst of the world's conflicts, as little prepared to deal with the real problems of life as if they had dropped from the moon.

It is hardly necessary to say that the actual state of our educational system satisfies neither of these extreme classes. The former are chagrined that so much has been already lost; the latter are discontented that so little has yet been won. But there has gradually been growing up a third class, limited as yet perhaps in numbers, who, withont falling in the least behind the first of those just described in their esteem for ancient learning, have perceived that the time has come when that learning must abandon its claims to an absolute monopoly of the educational field, and are now earnestly inquiring whereabouts in the educational course and to what extent it may profitably be superseded. It is to this class, small perhaps as yet in numbers, and inconsiderable in weight of influence, to which I avow myself to belong. Hitherto the attention of this class has been principally occupied with the teaching of colleges—taking it apparently for granted that the course of preparatory study, which is substantially the same everywhere, is susceptible of no material improvement, and needs no essential modification. But it is precisely at this point, as it seems to me, that modification is most necessary; and it is here that I desire to suggest that a suitable modification may be at once the means of accomplishing more efficiently the general ends of education (which is of course the matter to be first looked after), and of rendering at the same time instruction in classical learning, more productive than it is at present of tangible results.

More productive, I say, of tangible results. For what are, in fact, the results which we do actually reach in the teaching of the classics at this time? Are they in truth anything like what we claim for them? We hear, for instance, a great deal said of the intellectual treasures locked up in the languages of Greece and Rome, which it is asserted that our system of education throws open to the student freely to enjoy. And yet we know that practically this claim is without foundation. It will not, I presume, be affirmed of the graduates of American colleges generally, that they become familiar with any portions of the literature of

Rome and Greece, which do not form part of their compulsory reading. It will hardly be affirmed that one in ten of them does so. And why not? The reason is two-fold. First, there is hardly one in ten, in whose mind the classics ever cease to be associated with notions of painful labor. Reading is not, therefore, pursued beyond the limit of what is required, because it is not agreeable. But secondly and chiefly, there is hardly one in ten whose knowledge of the Latin or the Greek is ever sufficiently familiar to give him the command of the ancient literature which it is asserted for him that he enjoys. I suppose that to read with any satisfaction any work in any language, we should be able to give our attention to the *ideas* that it conveys, without being embarrassed or confused by want of familiarity with the machinery through which they are imparted. It will not be for mere pleasure that we shall pursue our task, if every sentence brings us a new necessity to turn over our lexicons, or to reason out a probable meaning by the application of the laws of syntax. And yet, if there are any of our graduates who are able, without such embarrassments, to read a classical author, never attempted before, the number must be very few. If there are any who can read even such books of Latin or Greek as they have read before, with anything like the fluency with which they read their mother tongue, the number cannot be large; and if there are any who can read with similar facility, classic works which they take up for the first time, it is so small that I have never seen one.

It appears to me, then, that the results actually attained under our present system of instruction, are neither very flattering nor very encouraging. We should certainly not have been so content with them as we seem, if we had not all along kept up before us the fiction that they are not what they are, but what they ought to be. For a period varying from seven to ten years, (four years in college and from three to six in preparation), we keep young men under a course of instruction in Latin and Greek; and, at the end of that time, they are unable, in any proper sense, to read either the one or the other. Can a person be said to know a language which he cannot read? And is it a result worth the time and labor expended upon it to attain such a doubtful acquaintance with a language or anything else, as that which the majority of our graduates carry away with them of these, at the close of their educational career? Might not the same amount of time and labor differently employed have produced, at last, something

having a value at least appreciable? And is not the immense disproportion between labor expended and results obtained, itself the best evidence that this labor has not been expended most wisely for the accomplishment of its own avowed end? For surely there cannot be any language, dead or living, in the known world, which any intelligent person ought not to be able to acquire, so as at least to read it, in a course of ten years' study.*

I know that we are continually informed, when we complain of the meagerness of the actual results reached in the classical teaching of our colleges, that it is not after all so much on account of the knowledge acquired that these studies are useful—it is because of the admirable intellectual discipline which they furnish, and which it is claimed for them that they only can furnish so well. This question we will waive for the moment; but in the meantime we may take occasion to note that the educationist who falls back upon this ground, admits in so doing, that the other is untenable, and that the value of these languages which has been so much insisted on, in opening up to the student all the choicest literary treasures of the world of antiquity, is for the majority of our graduates practically zero. And the admission may as well be made, though in making it we shall reduce to the form of empty pretense, and rate as no better than so much idle wind, a vast proportion of what has been written in eulogy of the educational uses of the classics. We may as well admit it, I say, because it is true; and until we recognize the truth in regard to the condition of our educational instrumentalities or methods, we can never proceed intelligently to make them better. Nor will it render the truth I insist on any the less positive, or the admission any the less necessary, that there may be here and there exceptions to the general rule, that now and then there may be found a student whose eight or ten years' study of the ancient languages may have really enabled him to read them. No one who claims this can claim that such cases are anything but exceptions. Even in the British Universities, where the preference given to classical study is greatly more decided than with us, and where its prosecution is

* It need hardly be said that there is no intention in these remarks, to question the fact of the existence among us of accomplished and thorough classical scholars. That we have such, and not a few of them, I am proud to believe. But how many of them became so in school or in college? That is the question immediately before us. Our scholars, as a rule, are self made. Their scholarship is the growth of their maturer life. The observations of the text are to be understood of American students at their graduation as Bachelors of Arts—not later.

stimulated by the promise of the most brilliant reward, even there such cases, though naturally more numerous than here, are only exceptional still. In fact their system would almost seem to have been expressly made for the production of these exceptions, and nothing else, without the slightest thought of or regard for the greatest good of the greatest number; for certainly it could not have accomplished the thing better, if it had been really devised with that deliberate intent. No system of performing the work of education, or for performing any other work, can be called a good system, which fails with the great majority and succeeds only with the few.

But then, if the argument so often used in defense of our system, derived from the great value of the classical knowledge it is presumed to impart, be fallacious, is not at least that which rests upon the disciplinary efficacy of classical study more substantial? Upon this point, again, there is some reason to believe that our educationists accept too readily what might be for what is. If mental discipline consists in invigorating the mental faculties by wholesome exercise, and in training them to habits of method in exercise, it is indeed certain that the study of language, undertaken at the suitable stage in the process of culture, must prove a most efficacious instrumentality—perhaps the most efficacious of all—for accomplishing this object. But to place before the immature mind a subject which might possibly later call into exercise certain of its powers, say for instance comparison, judgment, reasoning, is not by any means to insure that, under the actual circumstances, it will do so. It may hardly awaken an active faculty at all, and may remain merely matter of consciousness and memory. And especially is it probable that in early life the higher faculties, the reflective and reasoning powers will fail to respond to the provocatives addressed to them, when those provocatives consist of abstractions which are not themselves conceived without effort.

The first step, for instance, in the process of reasoning, is comparison. The easiest efforts of comparison are made when the objects are objects of simple perception; and if nature dictates anything on the subject of education too plainly to admit of mistake, it is that children should first be taught to compare by the help of visible things. But if this plain dictate of nature is disregarded, and we present to immature minds, as subjects of thought, definitions (for instance) of the parts of speech, or the

distinctions between the dative and ablative case, the probability is that no comparison or discrimination will be exercised at all, and that the only faculty which will come into play will be the memory. I say the probability is, but I might better say the certainty; and if personal experience is worth anything in the case, I may add that in one instance, at least, this certainty has been to me matter of knowledge.

Valuable then as is the study of language for its educational uses, it does not follow that it is so for the earliest stages of education. Still less, at that early period, will that language be found useful, of which the structure is the most complicated, the inflections the most numerous, the syntax the most artificial and the order of words and clauses in a sentence the most widely contrasted with that which prevails in the learner's own vernacular. And yet such a language possesses in the highest degree the properties which make of language a useful educational instrumentality, provided the proper place be assigned to it in the educational course.

There is a professor of physical training in New York who promises a wonderful development of the muscles of the arms and chest, to such as choose to practice under his direction for a few months in wielding certain ponderous clubs—thirty pounds, more or less, I believe, in weight. He can point to some striking living examples of the success which has attended his method; but I have never heard that he had placed his clubs in the hands of boys of ten years old. And so, when we impose on the intellects of boys at the same tender age, a burthen like that of the grammar of the Latin or the Greek language, we overtask them as much as we should overtask their boily strength by requiring them to go through a gymnastic exercise with a club of thirty pounds weight. They can lift the burthen no more in the one case than in the other. They do not lift it, though we may persuade ourselves that they do, because we tie them to it and leave them there. And by this I mean to say that the study of Latin and Greek, between the ages of eight and twelve (I have heard of cases in which the study began at six), does not really serve the educational purpose that it is supposed to do; does not really occupy the reflective and reasoning powers of the mind, but exercises almost exclusively the memory. But then, if it does not do this, it does something worse. It blinds us to the fact that the educational process is not going on at all, at the very most import-

ant and critical time in the youthful learner's life. It prevents us from perceiving that the mind which we are endeavoring to train, refusing a task to which it is unequal, remains inactive, except in the very humblest of its faculties. It conceals from us the unhappy truth that the perceptive powers remain dormant or sluggish; that the powers of comparison, analysis, judgment and reasoning, are never called into action; and that the period of life, when habits of careful observation are most easily formed, when in fact they must be formed, or never formed at all, is passing away unimproved.

To me, therefore, it seems to be an error of very serious gravity to suppose that the study of the ancient languages at a very early period of life is a means of valuable and wholesome mental discipline. That study seems to me rather, at that time, to act as a sedative, repressing the activity of the higher mental powers, than as a stimulant awakening them to exertion. And no stronger corroboration of the justice of this view could be presented than is to be found in the very moderate amount of attainment which appears in the end to be acquired, as the result of all this labor. The object of education, considered as a formative process, is not indeed directly the increase of knowledge. It is to form and not to inform the mind. But there is no process of formation which does not imply information. There is no species of mental exercise in which the understanding is not employed in the acquisition of new truths, or in forming new combinations of familiar truths, in such a manner as to enlarge the scope of our ideas. And in so far as the processes we call educational fail to increase knowledge, although not planned with that express intent, in precisely so far they fail to accomplish their proper end. There is then no impropriety in judging of the educational value of any study by considering how much it has contributed to the learner's stock of positive knowledge, and what proportion this addition bears to the time which has been devoted to securing it. Now, imperfect as is the acquaintance of our college graduates with the languages which occupy so largely their attention throughout their whole educational course, there is no doubt that the greater part of what they know of them is acquired after they become members of college. And yet, considering the exclusiveness with which, in the preparatory schools, they are confined to these subjects of study, there is as little doubt that the time they expend on them in those schools exceeds in most cases, and very much exceeds in many,

all that they can give to them afterwards. That is to say, in the earlier years the study is comparatively barren of results; it fails to impart an amount of knowledge bearing any fair proportion to the amount of time expended on it. And this fact is sufficient proof in itself that the disciplinary value of the study, at that period of the education, cannot be what has been claimed for it.

I shall be very much misunderstood if I am supposed, because of what I have said, to undervalue classical learning. I shall be misunderstood if I am supposed to desire to exclude the classics from our course of liberal education. No one places a higher estimate upon the ancient learning than I do.* No one feels more sensibly than I the force of all the arguments which have been urged in its favor. The influence which the perusal of the many models of literary excellence which it furnishes upon the formation of a correct taste in letters, the pleasure which the perusal of such affords to those who are able to read them freely in their original tongues, the importance of an acquaintance with the ancient languages to the correct understanding and scholarly use of our own, the many modes in which the history of ancient polity and ancient thought has affected the course of events in more recent times, in the political no less than in the intellectual world—these considerations, and others like them, will ever secure for the ancient learning a large space in any judicious system of liberal mental culture. Nor do I in the least question that the disciplinary value of these studies, considered as furnishing a wholesome mental gymnastics, is, when introduced at the right time, and in the right place, all that has been claimed for them. What I maintain is, that the right time is not, as the prevailing practice

* It seems worth while to insist a little upon this point. There is a great deal that is sensible and well worth attention uttered by the class of educational controversialists who take the greatest pains to display their contempt of classical learning; but this fails to impress their opponents, because their heterodoxy upon the point esteemed most vitally important discredits them with these upon every other. The writer is not to be confounded with such. He has labored as earnestly as any man in vindication of the claims of classical learning to the prominent place which it holds in our system of higher education—a place which he hopes to see it still maintain. But there is certainly danger, and a daily increasing danger, that it will lose this pre-eminence; and this appears to the writer to be inevitable, unless some such reform as is recommended above shall be introduced into the earlier periods of the educational course. So far, therefore, is the writer in what he has said from meditating any assault upon the classics, that he honestly believes that the prevalence of the views here advocated, and the practical consequences which would follow, would do more than anything else to fortify them against assault, and to quiet the growing disposition to assail them. This belief may be a mistaken one; but however that may be, its existence is an evidence that the foregoing remarks and reasonings are dictated by a friendly, and not by a hostile spirit.

assumes, the period of emergence from childhood, and the right place is not at the very beginning of the educational course. By giving them the false position which they at present occupy, we seem to me to accomplish three evils at the same time. First, we fail to secure anything like such a degree of attainment in the classics themselves, as the labor bestowed upon them ought to produce; secondly, we prevent the learner from acquiring much substantially useful knowledge, for which no opportunity so fitting will again occur; and thirdly—which is most important of all—we display a singular disregard of the plain indications of nature, who herself points out the order in which the faculties should be drawn out into action.

Curiosity is the most marked mental characteristic of childhood. This trait manifests itself in the thousand questions with which the child assails and often annoys all those who surround him. It manifests itself in the exuberant and enthusiastic delight with which he overflows at the sight of everything new. It manifests itself in the eagerness with which he lays hold of and scrutinizes every object within his reach which he does not understand. It manifests itself in the interest with which he traces the simplest effects to their immediate causes. It manifests itself in his lively sensibility to all the impressions of sense. It manifests itself in the activity of his observation of all the minute particulars of every new scene.

All these things serve to show how remarkably at this period of life the perceptive faculties are in advance of the others in the order of development. They furnish proof, if proof were needed, of what is nature's educational plan. And as it is sometimes permitted us to discover the wisdom of the order which the Supreme Creator has established to govern the works of his hands, so here we perceive of how inappreciable importance to the welfare of the race is the fact that the predominant characteristic of the infant mind is the instinctive desire to know, and how favorable to the rapid multiplication of ideas is the restless activity of the perceptive powers which accompanies this desire. For the child comes into the world totally ignorant. Even the simplest facts which it concerns his immediate personal safety to know, are to be acquired by him by observation and experience. That fire is hot and that ice is cold, that the moon is more distant than the candle, and that the candle is more agreeable to look at than to touch; these are rudimentary truths which it is useless to tell him—he must learn

them for himself. And in the same way all his elementary knowledge, of whatever description, must be acquired. Much of this is an acquisition earlier than language. It must be so, for language is but symbolic of ideas, and signs will not be used until there is something to be signified. In the earliest period of life, therefore, oral teaching is impossible. No medium exists through which it can be conveyed. The instructions of the parent or the nurse must be limited to the endeavor to enlarge the child's vocabulary by associating in his mind visible objects or recognizable expressions of emotion in the countenance or gesture, with the sounds by which these are recalled in language. To attempt to expound to him one word by the help of others is an absurdity never thought of. And even after language has been acquired, sufficient for the ordinary purposes of life, it holds for a long time but a subordinate place as an instrument of instruction. It may be employed with great effect to direct and assist the powers of observation, but if relied on solely as a means of conveying new ideas, the result cannot fail to be unsatisfactory. Objects, facts, phenomena, must themselves be directly presented to the learner, or there will be no substantial growth in knowledge. Seeing thus the absolute dependency of the child upon his own unaided perceptive powers for all his earliest knowledge, and seeing to how very great a degree he continues long to be dependent upon the exercise of the same powers for his subsequent advancement, we easily recognize the admirable wisdom of that provision of the Creator by which these powers, first of all and in the very dawn of life, spontaneously awaken, and manifest afterwards through all the earlier years of existence an activity which never tires, and which will not be repressed.

Now, I hold it to be the first principle of a sound educational philosophy, that the powers of the mind should be subjected to culture in the most natural order; and what I understand by natural order, is the order in which the powers unfold themselves when they are subjected to no artificial control at all. If this is not the test of what is natural, then we have no test. And I suppose that the reason why we should follow nature, is because nature will thus most willingly follow us. The tasks we impose will be pleasing, because they will be adapted to the strength. The learner will easily submit himself to our guidance, because we take him in the direction in which he is already inclined to go.

He will understand what we require of him, and he will be encouraged because he understands.

I do not mean to assert that any judicious course of instruction can be devised which shall present nothing but a series of unmingled delights. I am not of the visionary class who believe that continuous mental effort will ever, under any system, be attended, for the majority of individuals, with the same exhilaration and eagerness of spirit with which the same individuals are found to pursue the athletic sports by which their physical powers may be developed. They who, like Herbert Spencer, take such a ground as this, only injure the cause they would befriend, and weaken the force of their otherwise unanswerable arguments. The effort which is useful, whether it be physical or mental, must always partake of the character of labor, and labor brings with it sometimes weariness and pain. But what I do say is, that the labor need not be made a repulsive labor, as it always must be when it brings with it no recognizable, or at least no adequate profit; but may be made so richly productive as actually to become positively attractive.

Now, in what I have just said, I believe there is nothing which is not, in the abstract, perfectly orthodox—nothing which will not meet the approval of every educationist who hears me. I wish to inquire, therefore, to what extent it is practically true, that in our established system of liberal culture, we conform to the order which nature points out to us? Is it true that we make the development and training of the perceptive faculties the first object of our attention? Is it, as it ought to be, our first great aim to improve the powers of observation, of analysis, of induction, of classification? Are all the studies which we prescribe to boys, as preparatory to their introduction to the abstruser subjects of grammar, and logic, and ethics, and rhetoric, and metaphysics, directed to this end? Is there even a single one of them that is? We know that it is not so. Beyond those most elementary branches of knowledge which are indispensable as furnishing the implements by which all other knowledge is to be acquired—beyond orthography and reading and writing, the simplest rules of arithmetic, and perhaps some imperfect outlines of geography—to the great majority of the youth of this country destined for college, nothing at all is taught of any description, before they are required to devote themselves exclusively to the study of the most difficult languages ever spoken by man, and this by the

most difficult of processes—the purely synthetic. They follow up this species of study for several years. Few follow it cheerfully, for few follow it intelligently. Their progress is slow. The average attainment at the end of three, four or more years is far from being what it should be—far from what it might be could they have entered upon it with a proper preliminary training. Yet we do not appreciate the insignificance of the result, because the system itself has created a mean standard, according to which our expectations are adjusted.

They are then advanced to the college. The same subjects occupy them here as before, with the addition mainly of mathematics, logic and rhetoric, for two years longer; and then finally, as they approach the close of their educational career, they are for the first time introduced to the sciences of observation and experiment. That is to say, we have inverted the natural order just as completely as possible, placing those subjects which address themselves to the faculties earliest awake, at the very conclusion of the course. And this inversion of the order of nature carries with it the unfortunate consequence that no satisfactory knowledge is acquired at last, either of the sciences or of the languages. A large portion of my own life has been devoted to the teaching of physics. During all this time it has been manifest to me that my classes have come to this part of their course totally unpracticed how to observe. And it has seemed to me that their perceptive faculties have been actually dwarfed by the forced inaction to which they have been constrained during the period most favorable to their cultivation. Thus it has happened that the brief time which can only be given to these subjects in the college course has been exhausted in the attempt to convey such elementary notions as should have been familiar long before. And the same observation has been made to me by other gentlemen who are among the most skilled instructors in science that I have ever known. If, then, I am asked if I would displace these subjects from the position they occupy in the course of collegiate instruction, I would answer, by no means. What I would desire would be to secure such an early culture, and such an acquaintance with the elements of science, that it might be permitted us to give, at this more advanced period, such larger views and such profounder applications of the principles of these sciences, that the student might feel, in the end, that he had acquired some

mastery over them, and might be qualified to prosecute inquiry independently and profitably after he had mastered them.

Probably the faults of our present system of liberal education result to a great degree from the fact that our young men are in too great haste to be educated. It does not seem to me that the system can be radically reformed until our colleges shall decline to receive students below the age of seventeen or eighteen years. Some of them, perhaps a majority, have placed their minimum age at fourteen. Some of them have no provision of law upon the subject at all; but all receive candidates who give evidence of having read a certain limited amount of Latin and Greek. The other qualifications required are exceedingly moderate and are not very severely insisted on. Nor, though there are some who enter later in life, is it possible to secure to such the advantage this fact should bring with it. The course of study prescribed must be the same for all, and must not be beyond the capacity of the youngest. In the British universities, the average age of students at admission is, according to the reports of the royal commissioners, about eighteen years and a half. Were it the same with us, or were it a year less, there would be ample time in the earlier years for such a course of preliminary training as to insure, what we by no means now insure, a thorough education. But even without any such modification of our exactions as to age, there is still room for a sensible improvement of the existing state of things. And having said this, I shall probably be expected to state specifically what are the improvements which I consider practicable.

First, then, I would say that I believe that boys should not, as a rule, be required to take up the study of Latin before the age of fourteen or fifteen years. The earlier years may be much more profitably employed in other things; and if so employed, the study of the ancient languages may afterward be pursued much more rapidly and much more intelligently. It is a fact which has been frequently observed, which every teacher has probably observed for himself, that youths who have even not had the advantage of early systematic training, but possess only the greater maturity of the faculties which comes with advancing years, and who, at a period much later than the average, have resolved to fit themselves for admission to college, have been able to accomplish all that is required in a singularly short space of time, often within the compass of a single year. And such students, when

of ordinary native ability, have usually approved themselves among the most thorough linguists of the classes to which they belonged. There is no doubt that two years is as good as two dozen for the acquisition of all that our colleges require of preparation in the classics, provided violence be not done to nature by forcing the study upon minds unprepared to receive it.

During the earlier period now occupied with weary, and to a great degree profitless, labor over uncongenial studies, I would introduce, first, the sciences of classification, embraced under the general name of Natural History—as botany, zoölogy, mineralogy. No subjects are better suited than these to gratify the eager curiosity of the growing mind; to satisfy its cravings after positive knowledge; to keep alive the activity of the perceptive powers; to illustrate the beauty and value of method, and to lead to the formation of methodical habits of thought. That these subjects will interest children of very early years, and that such children will require no painful constraint to secure their attention to them, I have myself seen experimentally verified; and the testimony of Professor Hooker, before the Royal Commissioners appointed to inquire into the condition of the public schools of England, in regard to the success of his distinguished relative, Prof. Henslow, in giving instruction in the same subjects in one of the humblest schools of England, is conclusive to the same effect. The lessons of Professor Henslow were given to children between the ages of eight and fifteen. The attendance was altogether voluntary. The children became deeply interested in the subject of botany, learned to analyze and classify plants, to distinguish the relations of the parts of plants to each other, and of one plant to another. The result was a very obvious improvement in the powers of observation and of reasoning, and an increase of general intelligence. These effects were so sensibly manifest, that some of the inspectors of the schools remarked that these children were decidedly more intelligent than those of other parishes, and attributed the fact to the training which their observant and reasoning powers had received from this instruction.

Along with these sciences, I would teach those which depend on observation and experiment, embracing chemistry and the various branches of physics. As in natural history we have classification of individuals referred to form, so here we have classification of facts and phenomena referred to law. These sciences present the happiest examples of reasoning in both the inductive and

deductive forms. They lead to the formation of habits of arranging premises and deducing conclusions which accord most with the daily exigencies of human life, and thus promote that soundness of judgment which is among the most striking characteristics of practical men. Of course, it is not to be expected or desired that, in the early period of education, these sciences should be pursued into their abstruser developments. The deductive part of physics involves, in many portions, the application of the higher mathematics, and opens up branches of inquiry which must be left to be supplied at a more advanced period; but that which is simply inductive addresses itself to the senses, and not only may be easily understood, but never fails to prove intensely interesting even to very young learners.

So much as is here suggested, is actually required as a qualification for admission to King's College, London, or for matriculation in the London University. The eminent physiologist, Dr. Carpenter, who is one of the examiners for the London University, in his evidence before the commission already referred to, speaks of the requisition as most important and useful. And the opinions expressed by him are supported by the unanimous voice of all the other witnesses of the same class who speak to the point, embracing some of the most distinguished physicists of England, and presenting a weight of authority entitled to the highest respect. Among these we find the names of Lyell, Hooker, Faraday, Owen, Airy and Ackland. We have these names, because these gentlemen were summoned before the commission. But it is assuming very little to say that we might have had along with them those of every eminent physicist in England, had they all been in like manner called upon for their evidence.

The adaptedness of this class of subjects to the mental wants of boys in the earlier period of their education, and its fitness therefore, to fasten their attention and keep alive their mental activity, is manifested in the earnest interest they display in any description of physical or chemical experiments, and in the eagerness with which they will endeavor to imitate such and contrive new ones. It is manifest in the curiosity they exhibit to witness the action and to understand the rationale of every new machine which falls in their way, and in the efforts to invent or to construct for themselves, which form a part of the early history of almost every youth. It is interesting to any one to be introduced at any time of life into a great cotton mill or foundry, or manufactory of any

description which he has never seen before; but to a young lad, whose observant powers are in the morning of their development, and who possesses the lively impressibility belonging to that early age, such a visit is a source of delight beyond all measure, and it is often found almost impossible to tear him away from objects which so fill him with admiration and gratify his desire to know.

If it were proper here to refer to matters of personal history, in illustration of what I have asserted of the fitness of the sciences of nature to occupy the place of precedence in an educational system founded upon that sound philosophy which consults first the demands of nature, I would say that the point of my own life to which, at a distance of more than forty years, I look back as that in which my education truly began, was that at which, while engaged in the irksome study of the dead languages, which, for the seven years preceding my admission to college, crushed me down like an incubus, I had an opportunity to attend a course of lectures on chemistry, magnetism and electricity by an itinerant lecturer. It seemed to me that a new world had suddenly been revealed to me. From that time forward I could think of nothing else. It was my constant amusement, with such rude materials as I could gather, to repeat the experiments which I had seen, and to endeavor to devise new ones. Cut off from books of my own on those subjects, I improved my time during the holidays which permitted me to visit home, in devouring the text books of a sister, who being superior to me in age, was pursuing in her own school, subjects which, according to the received theory, are more advanced than those then allowed to me—that is to say, the dead languages. In assuming, therefore, that those subjects are the subjects best suited to early mental culture, I do not merely put forth opinions founded on considerations *a priori*, I speak with the conviction which results from actual experience.

But these subjects are recommended not only on educational grounds, but because they embody in themselves a vast amount of substantial knowledge, such as cannot fail to be of the highest practical usefulness in life. They relate to the real and material world by which man is surrounded, and in the midst of which he lives. Whatever may be the value of the study of the classics in a subjective point of view, nothing could possibly more thoroughly unfit a man for any immediate usefulness in this matter of fact world, or make him more completely a stranger in his own home, than the purely classical education which used recently to

be given, and which with some slight improvement is believed to be still given, by the Universities of England. This proposition is very happily enforced by a British writer, whose strictures on the system appeared in the London *Times* some twelve or thirteen years ago.

"Common things are quite as much neglected and despised in the education of the rich as in that of the poor. It is wonderful how little a young gentleman may know when he has taken his university degrees, *especially if he has been industrious, and has stuck to his studies.* He may really spend a long time in looking for somebody more ignorant than himself. If he talks with the driver of the stage coach, that lands him at his father's door, he finds he knows nothing of horses. If he falls into conversation with a gardener, he knows nothing of plants or flowers. If he walks into the fields, he does not know the difference between barley, rye and wheat; between rape and turnips; between lucerne and saintfoin; between natural and artificial grass. If he goes into a carpenter's yard, he does not know one wood from another. If he comes across an attorney, he has no idea of the difference between common and statute law, and is wholly in the dark as to those securities of personal and political liberty on which we pride ourselves. If he talks with a county magistrate, he finds his only idea of the office is, that the gentleman is a sort of English sheik, as the mayor of the neighboring borough is a sort of cadi. If he strolls into any workshop or place of manufacture, it is always to find his level, and that a level far below the present company. If he dines out, and as a youth of proved talents, and perhaps university honors, is expected to be literary, his literature is confined to a few popular novels—the novels of the last century, or even of the last generation, history and poetry having been almost studiously omitted in his education. The girl who has never stirred from home, and whose education has been economized not to say neglected, in order to send her own brother to college, knows vastly more of those things than he does. The same exposure awaits him wherever he goes, and whenever he has the audacity to open his mouth. *At sea he is a landlubber, in the country a cockney, in town a greenhorn, in science an ignoramus, in business a simpleton, in pleasure a milksop,*—everywhere out of his element, everywhere at sea, in the clouds, adrift, or by whatever word utter ignorance and incapacity are to be described. In society and in the work of life, he finds himself beaten by the

youth whom at college he despised as frivolous or abhorred as profligate. He is ordained, and takes charge of a parish, only to be laughed at by the farmers, the trades people and even the old women, for he can hardly talk of religion without betraying a want of common sense."

I know that with a pretty large class of educational philosophers, when methods of education are under discussion, the word *usefulness* has long been tabooed. I know that with such, to speak of a subject of study as likely to be productive of direct and practical and tangible benefit to the learner in the real business of life, is to bring that subject immediately under suspicion, if not to insure its summary condemnation without any examination of its claims. I cannot but hold, on the contrary, that if we can find any subject which, while it is capable of affording the most salutary intellectual exercise, is also certain to enrich the student with a store of knowledge of that very kind of which he is going to feel the need every day of his life, then this subject should have a place in our educational schemes in preference to any which can only claim the first of these advantages without possessing the second at all.

The kind of lofty contempt or aversion to subjects recommended for their practical utility, which is manifested by the class of educators to which I have referred, appears to be founded upon an assumption which has been so long taken for granted, that for them it has passed into a kind of axiom, and that is, that a subject of knowledge which is adapted to educational uses cannot be, or at least is extremely unlikely to be, of any other direct use in the world; and conversely, that a subject which is self-evidently practically useful can by no possibility have any educational use whatever. According to them, therefore, as it has been very well remarked before, nature seems in respect to this particular matter to have deviated from that rule of severe economy which distinguishes her everywhere else, and to have ordained a necessity for two sets of machinery where one might have sufficed—ordained, that is, that the mind shall require one class of studies for subjective culture, and another class for its furniture—one class to make it fit for work, and another class to provide for it material to work upon. The fallacy of this doctrine has been so well exposed by abler hands—notably by Dr. Hodgson, of England, and by Mr. Atkinson in our own country—that I will not dwell upon it here.

I mention it only for the purpose of entering my protest against any disparagement of the studies which I would recommend as preparatory to college, to be deduced from the consideration that they have upon them the taint of possible usefulness.

Adjourned.

AMERICAN INSTITUTE POLYTECHNIC ASSOCIATION,
April 25, 1867.

Prof. S. D. Tillman in the chair; J. Wyatt Reid, Esq., Sec'y.

The chairman presented his usual budget of scientific news, as follows:

EFFECT OF CELIBACY.

Dr. Stark, of the Register Office, Scotland, has found, on comparing the vital statistics of married and unmarried men who have lived beyond the age of twenty-five, that the average life of married men is a little more than sixty years, while that of bachelors is less than forty-eight.

FIRING GUNS BY ELECTRICITY.

The well known method of firing gunpowder with a platinum wire, made red hot by a galvanic current, has been applied to guns in France—the only novelty being in carrying two small electric batteries in the stock, the two connecting wires of which emerge near the breech, and are so arranged as to be connected when a current is required to explode the powder.

MOURNING CANDLES.

Böttger states that the mourning candles used in Germany are made by heating paraffine with the shells of the Anacardian nut, which contain a black resin soluble in paraffine. While the paraffine is liquid, it is of a dark brown color, but on becoming solid it is jet black. When the candles made of such colored paraffine have a very thin wick, they burn without giving off any unpleasant odor or vapor.

TEST FOR STARCH OR GRAPE SUGARS.

Picric acid, one of the derivatives of phenol, formed by the action of nitric acid on phenic acid, is of a yellow color. A few drops of a solution of picric acid in 250 parts of water is added to a solution of this kind of sugar (glucose) containing a little caustic soda, and heated to 90°. The mixture, when boiled, assumes a

blood-red color, a result from the formation of picramic acid. A solution of cane sugar (sucrose), added to a solution of picric acid, does not produce this change of color.

A New Gunpowder.

Dr. Borlinetto has invented a new explosive compound, consisting of 10 parts of nitrate of potash, 10 parts of picric acid, and 8½ parts of bichromate of potash. The ingredients are to be separately reduced to a fine powder, and then intimately mixed. Some time since he proposed to use a mixture of chlorate of potash and tannic or gallic acid. A compound almost identical with this had been previously the subject of experiment, yet no practical application of it is now made, owing to the uncontrollable violence of the explosion. Ordinary gunpowder is not likely to be soon superseded, on account of its comparative cheapness and the extensive facilities for making it.

Extraction of Aroma.

We lately gave the process for obtaining from flowers their peculiar perfume by means of bisulphide of carbon. The light product of crude petroleum has been found to be a capital substitute for the bisulphide. This purified naptha readily takes up the odor of flowers, which are continually added until the compound is saturated, after which it is driven off by evaporation. The perfume may be separated from the oily matter associated with it by means of pure alcohol, which in small quantities does not unite the latter. The aroma of several spices may be extracted in the same way; thus, too, may be secured the valuable medical properties of a plant, particularly when they reside in its flowers. Care must be taken to exclude the volatile naptha from the vicinity of fire.

Surveying in Siberia.

The topographical corps of the Russian Government has been for some time employed in surveying the Kirghis Steppes, and the vast tract of country lying between Siberia and China. They have marked down the line of road by which the caravans travel from the southern regions of Central Asia to the frontiers of the two great empires. The northern part of the Tarbagatai chain of mountains and the valley of the river Borokhandzir were included in the operations, as well as the country beyond the river Tchou. All the surveys have been mapped on a scale of 250 sagenes

(1,750 feet) to the inch; plans of forts have been taken, and the best routes for troops on the march have been carefully noted. The area surveyed in four years comprehends about 300,000 square versts (131,887 square miles); and the surveyors can now show on their maps an expanse of territory stretching without a break along the Asiatic frontier from the Pacific to the Caspian sea; from the valley of the Ussuri and the peninsula of Corea to the Ust Urt, Turkestan and Khorassan.

Eozoön.

At a meeting of the Natural History Society of Montreal, in January last, a photograph was exhibited of a remarkable specimen of *Eozoön Canadense*, found in the Laurentian limestone of Tudor, Canada West, which was described by Dr. Dawson. Under the microscope, the minute structures of the Eozoön were detected, though less distinctly perceived than in some of the specimens mineralized by serpentine. In some chambers are small amorphous bodies containing pointed siliceous spicules, which seem to be the remains of sponges that have established themselves in the cells after the animal matter of Eozoön has disappeared. This specimen seems to establish conclusions previously made from the study of similar remains included in the serpentinous limestones, and to overthrow objections raised as to the organic origin of of Eozoön. Sir William Logan will lay this specimen before the Geological Society of London, along with other recent discoveries tending to the establishment of a second species of Eozoön.

Germination and Vegetation.

M. Carey Lea has recently made several experiments to determine how far the germination of seeds and the growth of plants are influenced by the action of very dilute solutions of acids, salts, and neutral bodies. In his first experiment he tied over the top of twelve glasses, each holding twelve and a half ounces of water. pieces of very thin muslin which were allowed to dip into the liquid. Twenty perfect grains of wheat were placed on each piece of muslin. Into the glasses respectively were put one drop of sulphuric acid, two drops nitric acid, three drops hydrochloric acid, five grains bicarbonate of potash, five grains dry carbonate of soda, five grains sulphate of soda, twelve grains chlorate of potash, ten drops of weak ammonia solution. A pair of zinc and copper plates in plain water, and connected above it by a wire, a similar pair in water containing three drops of hydrochloric acid,

one glass containing only plain water for comparison. At the end of forty-eight hours, germination was evident in each case; at the end of the third, fourth, fifth and sixth day, vegetation was most advanced in the three glasses containing respectively plain water, bicarbonate of potash, and sulphite of soda. On the sixth day, the least advanced was seen in the glasses containing the three acids; the hydrochlorine acid glass being behind all.

In the bicarbonate of potash solution the same number of grains germinated as in plain water, but in the solution of sulphite of soda the number of germinating grains was one-fourth less, although the plants attained the same height as in the plain water. He concluded that bicarbonate of potash was least injurious of all the substances tried; next was the sulphite of soda; and next the carbonate of soda. The presence of an electric pair did not check germination, but reduced vegetation one-third. In his next experiments he included certain organic substances, cane sugar thirty grains, gum thirty grains, glycerine one fluid drachm, and of one vegetable acid (citric) five grains; also, permanganate of potash two grains, nitrate of ammonia twenty grains. A large proportion of sulphite of soda was used, twenty grains, and only one-fourth the quantity of sulphuric acid. At the end of thirteen rather cold days, from the 10th to the 23d of December, it was found that in the citric acid and permanganate of potash solution no roots were formed although the plants had grown an inch high. At the end of a month the roots in the sugar cane solution were only an inch in length, while those in the gum and glycerine solutions had reached the very bottom of the vessels. Vegetation was as active in the last three named solutions as in pure water, and some of the plants in the gum solution were fully one-half higher than in the other three liquids. The plants in the solutions of sulphite of soda and nitrate of ammonia were very slightly in advance of those in plain water.

Ventilation of Ice-bound Fish Ponds.

Mr. C. Tomlinson, in *The London Chemical News*, after alluding to the common practice of breaking the ice on a fish-pond to supply the fish with air, raises the question how are natural lakes and ponds supplied with air? On consulting books he was surprised to find a contradiction on the part of naturalists of repute. Swainson ascribed the loss of thirty or forty fine tench, in a pond covered with unbroken ice, to the extreme cold. In opposition to

this opinion he quotes the Arctic explorer, Franklin, to prove the extraordinary vitality of fish under the influence of a much lower temperature, in regions where the fish froze as they were taken out of the nets, and in a short time became a solid mass of ice. If in this completely frozen state they were thawed before the fire, they recovered their animation. The carp, for instance, would thus recover so far as to leap about with much animation after having been frozen for thirty-six hours. Herne, Ellis and others, state that musketoes and other insects frozen into a black, solid mass—spiders frozen so hard as to bound from the floor like a pea—frozen leeches, frogs and snails, all recovered their energies when thawed before the fire. These facts seem to prove that although fishes may be made torpid by cold, and so not require air, yet in their active state they must be supplied with this necessary condition of life. The appetite for air is, no doubt, different in different species. If carp and tench in an aquarium be watched, it will be found that the carp frequently seek the surface for air, while the tench remain at the bottom. If various species be crowded together in a tub of water, such as minnows, dace, roach, gudgeons, &c., some will die long before the others for want of air. Boccius, a practical manager and constructor of fish ponds, distinctly recognizes the necessity of supplying air to the water during frost.

Experiments on the freezing of aerated waters show that when they are frozen rapidly the air becomes entangled, and opaque, milk-white ice is the result; but when the cold operates gradually, clear crystalline ice is formed ; or if the air cannot escape, clear ice is first formed, and afterward the opaque aerated ice. A friend has informed Mr. Tomlinson that a considerable number of small blue roach had been killed in the ponds about Bromborough from the sudden freezing of the ice. These ponds are very shallow, and a sudden frost would entangle in the ice much of the air of the water. On the other hand, if the cold increase gradually, the water has time to separate the air, and no sooner is a crust formed on the surface than this separation proceeds downward, and often with such effect as to collect the air in lenticular masses, which appear of a light color amid the black ice. In this way the freezing proceeds downward, and if the water be moderately deep, the fishes not only enjoy a comparatively mild temperature, but have air enough until the frost breaks up, unless, indeed, it be of unusual duration.

Deep ponds and lakes are slow in freezing, because the whole body of the water is slow in attaining the maximum density by cold; and until this is done the surface cannot sink to 32° Fah. On the other hand, rivers and streams are slower in freezing than stagnant shallow water, the motion interfering with convection and also with crystalization. Ponds and lakes are often fed by springs and streams, so that if the former be frozen on the surface the latter may be active; and if they find their way into ice-bound water, they will carry in much air. In small collections of water, where the temperature is low enough to lock up the springs, air may be supplied by a portion of the water sinking into the soil. Action like this is seen on country roads, when a sharp frost sets in after rain. The water that collects in the wheel ruts, &c., freezes at the surface in blades of ice that cross at angles of 60. If this ice be tapped with a stick a few hours after, it will be found to cover a hollow space, from which the water has been absorbed by the soil. If water thus settles away beneath a frozen pond, the ice is left unsupported, except at its edges, and the air would surely find its way beneath it either through cracks in the ice or through the soil.

Colored Rain.

Mr. H. L. Eades, of South Union, Ky., states in *The Scientific American* that on the night of the 12th of March last, there was a copious fall of rain and vessels left in the open air were found in the morning to contain water impregnated with a yellow substance; a specimen of it was sent to the editors, which has been subjected to a microscopic examination by Dr. Dinwiddie, and found to consist of a species of pollen, probably from the pitch pine.

An article by Edwin Durkin, of the Royal Observatory of Greenwith, has lately appeared, from which we select the following instances of apparently colored rain and snow in comparatively modern times. The first was a memorable example of colored rain known to have fallen at night in the Hague in 1670. People of all classes were affected by this mysterious rain of blood, which they regarded as a miraculous act of Providence, foretelling scenes of approaching war. There happened to be a physician in the town whose scientific curiosity urged him to inquire into the cause of this wonderful phenomenon. He examined some of the water with a microscope, and found that it had not really changed color, but that the blood-red was produced by swarms of red animals or

insects of perfect organization and in full activity. They were a kind of water-flea, with branched horns, called by Swammerdam *Pulices arborescentes*, but how they became so suddenly multiplied has never been explained. Something analogous to this occurred at Greenwich a few years ago. During a very gloomy rain a universal deposit of small black flies took place, and in some instances plants were completely hid from view. About eleven years ago a similar deposit was noticed at Cambridge, England. On the 14th of March, 1813, the inhabitants of Gerace, Calabria, were greatly alarmed by a thunder storm during which they saw large drops of red rain. In another part of Italy colored rain fell under similar circumstances. Sementini analyzed a portion of it, and found that the coloring matter consisted of light dust of a marked earthy taste, which under heat became brown, then black, and finally red. It consisted principally of silica, alumina, lime, carbonic acid, oxyde of iron, and a yellow, resinous substance. It is very probable that these and similar specimens of colored dust were first emitted from an active volcano. After being carried a considerable distance through the upper regions of the atmosphere, they finally descended in the form of rain. A shower occurred at Oneglia, Piedmont, on the 27th of October, 1814, which left on trees and grass the appearance of blood spots. Messrs. Mayer and Stook, chemists, of Bruges, analyzed some of the colored matter which fell during a shower in 1819, and found it was principally chloride of cobalt. Prof. Giuli subjected to analysis a deposit on the leaves of the plants in the Botanical Garden at Siena, Tuscany, and found it to be composed of some vegetable organism in combination with several oxides and carbonates. The deposit after a remarkable rain on the 19th of February, 1819, in the district between Genoa and the Lago Maggiore, consisted of talc, quartz, carbonate of lime, bituminous matter, and remains of seeds of different plants. On the 9th of November, 1819, the city of Montreal, Canada, was suddenly enveloped in darkness, when rain as black as ink began to fall. Some of this liquid was sent to New York for analysis, and the coloring matter was found to consist simply of soot. Its origin was doubtless a great fire in the forests of Ohio; during its progress the wind blew steadily towards the north. Similar black rains have been reported in the United States. In Scotland they have been frequently noticed. A remarkable rain occurred on the 24th of April, 1781, in the island of Sicily. The water, on evaporating,

left a gray cretaceous deposit of nearly a quarter of an inch, which was supposed to have been emitted by the volcano of Etna. Colored snow, doubtless, is the result of a deposit of vegetable origin. In the middle of the last century, M. de Saussure, so celebrated for his Alpine and meteorological researches, discovered a considerable quantity of red snow on some of the high mountains of the Alps. In 1778 he made an analysis of some collected on Mount St. Bernard, and proved that the coloring matter was a vegetable substance, possibly the farina of some flower. It is now known that the red color of snow is sometimes due to a minute species of lichen. Capt. Ross, during his first voyage to the Arctic regions in 1818, collected some of the coloring matter from the crimson cliffs discovered near Cape York, on Baffin's Bay, and visited by Kane in July, 1855. Under the microscope it was found to consist of particles like a very minute round seed of a deep red color. On some of the particles a dark speck was also seen. On his return to England, Capt. Ross placed several bottles of specimens in the hands of Dr. Wollaston, who, after an examination, stated that the red matter consisted of minute globules, from one-thousandth to three-thousandth of an inch in diameter. Their coat was colorless, and the redness belonged wholly to the contents, which seemed to be of an oily nature, and not soluble in water. M. Thenard, M. de Candolle, Robert Brown and others, have expressed their opinion as to the vegetable character of the deposit, but from what plant it was derived is not so satisfactorily settled. We may here add that in the Grisons, France, there was, last winter, a fall of red snow, to the depth of three inches, continuing for two hours. The phenomenon is said to be due to the presence of a microscopic mushroom, the *protococcus nivalis.*

Ice a Preventive of Aeration.

The reading of one of the foregoing items, relating to ice in fish ponds, reminded Dr. Vanderweyde of a curious effect of ice preventing the absorption of air by water. The city of Philadelphia is supplied with water from the Schuylkill river, which is pumped into an elevated reservoir. Some miles above the city are several manufactories from which refuse matter is drained into the river. For some distance the water is quite dark, owing to the presence of organic substances, but as it approaches the city it becomes clearer—the oxygen of the air having been absorbed and the car-

bonic acid deposited in combinations in the form of mud. During last winter, when the river was frozen, no oxygen was, of course, absorbed, and the consequence was that there were numerous complaints of the impurity of the water.

Safety-fender for Horse Cars.

Mr. John Price exhibited a guard to prevent the wheels of cars from injuring persons falling on the track. It was simply a fender made of thick sheet iron placed in front of the wheels, or rather outside of the wheels, at each end of the car, and extending to within a few inches of the track. The exhibitor stated it could be put on a car for thirty dollars. Its weight was 180 pounds.

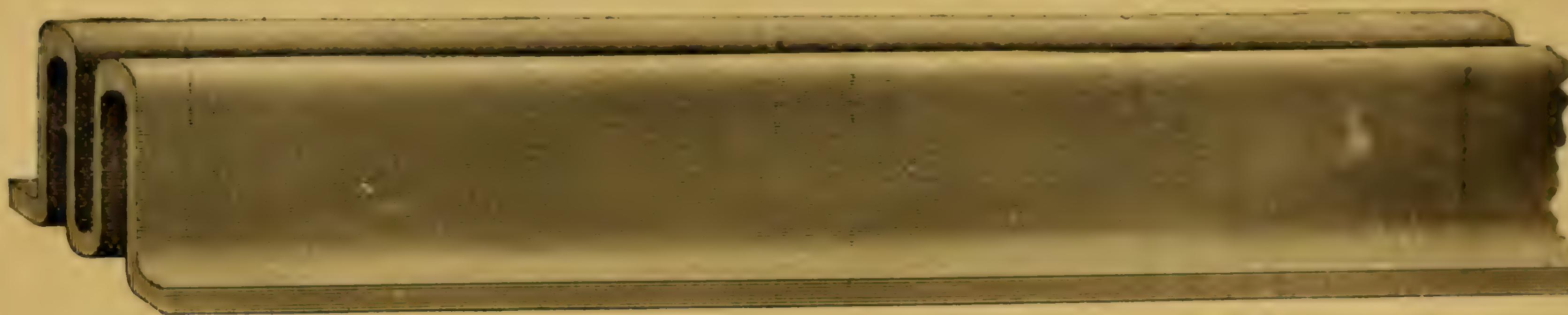
Double Rails.

Mr. R. Montgomery exhibited specimens of his elevated rail track for wheels having a flange in the middle; also a model of an elevated railway, showing his plan for supporting the rails, which are made like his metallic bridge beams, as shown in the annexed illustration. The pillars which serve as supports can be used as telegraph poles, lamp posts, &c.

Holz's Revolving Electrophorus.

Dr. Vanderweyde explained the principle and construction of Holz's new machine for generating electricity· manufactured by J. N. and S. Chester, 104 Center street, New York. Two kinds of electricity are known ; one is statical, or that produced by friction, and the other dynamical, or that which is effected by chemical action, as galvanism, which is known only as a current, while statical electricity may be accumulated. For some time, since the discovery of Galvani, in 1780, statical electricity has been neglected, but of late important discoveries have been made, amongst which was this machine of Holz's, which, in appearance, is not unlike an ordinary plate glass machine ; it does not, however, produce electricity by friction, but by *induction*. A sheet of paper placed within a short distance of the disc is charged with a small portion of the electric fluid, then the disc is made to revolve, and induction draws from the atmosphere electricity which is collected by metallic points. This machine is worked more easily than the ordinary one in use, but is not intended to supersede it.

Montgomery's Metallic Beam.—Used in connection with Corrugated Iron.



(See "Double Rails," page 970).

To Prevent Incrustation in Boilers.

Dr. Vanderweyde exhibited a model of his contrivance for preventing incrustation. It consisted of a representation of the common horizontal boiler, to which is attached on the inside or upper part of the steam room, a series of metallic rods, resembling lightning rods, pointing downwards, which were intended to carry the positive electricity of the steam to the bottom of the boiler, where it, discharging in the water, repels the electro-positive deposits. He also presented the following paper:

Uses of Electricity in Preventing Scale in Steam Boilers.

Observing the mysterious and powerful effects produced by electricity, it is not surprising to find persons who ascribe almost everything they cannot explain, to this agent. Thus, unaccountable steam boiler explosions were explained by "electricity," and attempts were made to discharge this supposed "exploding electricity" from the boiler. Others supposed that electric currents would prevent explosions, and confounding electricity with magnetism, made all kinds of absurd experiments, as, for instance: Perry, of Philadelphia, of whom an application for patent made May 2, 1864, was rejected, for reason of its absurdity. He obtained, however, a patent October 31, 1865, (No. 50,773,) in which he claims: First, "suspending within a steam boiler one or more permanent magnets for inducing an electric current." Magnetism and electricity are not identical, they are only related together, but in a much lesser and different degree than light and heat, and this claim of Perry is as absurd as it would be to suspend a kettle of hot water in a room in order to illuminate it. A second claim added to this patent describes a hollow box, with isolated lining, through which a conducting rod projects—evidently destined to give escape to the *explosive electricity!*

Others, observing how electricity can shock a man, and how a small battery can put his muscles in continual vibration, conceived the idea of connecting the steam boiler with a powerful galvanic battery, in order to put it "in vibration, and shake scales or incrustation loose from it," as if a steam boiler had muscles or nerves, and could possibly be shocked by electric currents. All those familiar with the subject know that such a large mass of metal as a steam boiler consists of, will conduct the strongest electric currents we possibly can produce, silently and imperceptibly. However, an application for patenting this principle is at the present

moment (March, 1867,) pending at the Patent Office in Washington, waiting for a decision.

Porter, of Philadelphia, had also (October, 1865, No. 50,774,) a patent granted, where he uses a similar isolating arrangement, and an isolated point projecting out of the boiler—evidently, again, a discharge of the *explosive electricity.* But he adds a long spiral wire, such as when wound around a wrought iron bar charges it with magnetism by means of a galvanic battery, only the iron bar and the battery are omitted, and the inside of the spiral is empty; this spiral wire, now entirely useless, is at one end connected with the boiler, and at the other isolated end is a disk attached, with a few small points. It is evident from this whole arrangement that the experiments and attempts were made, as it were, blindly, in ignorance of the principle to be applied, and not clear about the results to be arrived at.

The apparatus was placed inside some steam boilers, hoping to get rid of that dangerous *explosive electricity*—that cause of so many disasters—and, it is said, that some unexpected result was obtained, namely, it was asserted, that these boilers remained free from incrustation, and that even scales already formed got loose. Now this may be true in a few instances, and prove nothing for the arrangement, as all practical engineers know how capricious steam boilers are in this respect, how some will form scale, and others in perfect similar circumstances, and using the same water, will not; how even the same boiler one season will be covered with incrustation, another season will not form any scale whatever, perhaps produced by the difference in the water in different seasons, or by causes which we cannot always trace. Then it is very easy to place in the steam boilers some chemical substances, for instance *sal ammonia* and *gum catechu*, the presence of which will protect any boiler from incrustation for about three months. But, whatever may have been the cause, to the Porter arrangement a certain credit was given as an anti-incrustator. Some enterprising gentlemen got hold of the patent, and resolved to form a stock company and put the apparatus in the market.

Then every man of science knows that to effect those repulsions, even to a weak, scarcely perceptible extent, the most powerful electro-magnets, charged by large galvanic batteries, are required, magnets capable to carry, when attracting iron, a ton or more in weight, and that the bodies have to be brought immediately

between their most powerful acting parts, the extremities, or so-called poles.

In order now to make the diamagnetic theory applicable to Porter's arrangement, or so called steam battery, the idea of Perry, of suspending magnets in the boiler, has been combined with it, and the little points Porter speaks of (but which he had no idea of magnetizing), have been magnetized—a perfect useless and absurd operation, solely introduced to cause the apparatus apparently to agree with the preconceived diamagnetic theory.

I call the magnetizing of these small points absurd, for the following reason: When points are only two or three inches long, and of the thickness of a lead pencil, their power is so weak that they can scarcely support a common nail, and it cannot be made more; on the contrary, it is always greatly diminished, and always ultimately destroyed by the high temperature to which they are submitted in the steam room of a boiler.

How any one, who pretends to a scientific knowledge, combined with common sense, can possibly seriously assert that these small magnetic points, when suspended in one corner of the steam room of a large boiler of several tons weight, will "put the whole entire surface of this boiler in a condition of magnetic polarity," so that it will "forcibly keep away from the iron surface" all diamagnetic bodies, and even loose the scale already formed, "so that the pure water will penetrate between the mutually repellent surfaces of scale and iron when the latter becomes magnetic," all this is more than I can understand.

It appears that in some localities, for instance, at the iron works along the Lehigh river, the incrustation in the boiler is formed so rapidly that the insufficiency of the apparatus is proved every three months; but then the magnetic points are good for such a contingency, they are blamed as being the cause, by having lost their magnetic power; they are removed, and of course found very weak, like they necessarily become in all boilers. New, fresh ones are inserted; but nothing is easier than at the same time to introduce some *soda*, *sal ammonia*, *gum catechu*, etc., which in a few weeks will loose the old scale, and during a few months prevent the formation of new scale; and then all the credit may be given to the freshly magnetized points of the anti-American incrustator.

I will now notice two other patents of a similar nature, one granted anterior to all the above, the other recently issued.

The first, of Webster & Young, is founded on the following principle. Suppose that two different metals, for instance, iron and copper, each of which singly would be chemically acted upon, or oxydized by a liquid, say sea-water, are united by means of a metallic connection, and both metals plunged in that liquid, then only one will be oxydized (the iron), and the other (the copper) will be perfectly protected at the expense of the first (the iron), which will so much the stronger be oxydized, and this protective action of the first (the iron) will last till it is all dissolved or oxydized. The cause of this phenomenon is, that a galvanic current is excited by the electro-positive metal (the iron), which circulates through the connection and the liquid and so protects the electro-negative metal (the copper).

Some fifty years ago, this principle was applied by Humphrey Davy, to prevent the corrosion of the copper coating of vessels by sea-water. The positive metal he used was zinc, of which different pieces were soldered at several places against the copper lining of the vessel. It was, however, found that not only a protection against oxidyzation was afforded to the copper, which lasted as long as there was any metalic zinc left, but that, also, deposits of marine vegetation, of barnacles, etc., were formed against the copper, so that the bottom became as foul as is the case with wooden ships; so it was abandoned, because one of the greatest advantages in coppering vessels is that the poisonous green compound of copper continually forming on the surface has a strong tendency to keep the ship clean.

A few years ago, Webster & Young took out a patent to apply this same principle for preventing incrustation in steam boilers. They suspended in the water a rod or plate of copper, or any other metal, electro-negative in comparison with the iron of the boiler, and connected with it in such a way that any galvanic current could circulate through the water, and back through the metallic connection. They intended that the thus suspended plate, by the galvanic attraction, should receive all the deposits and salts from the water, which it must necessarily do, like as the copper coating of ships receives ocean deposits. But as this deposit on ships is formed at the expense of the zinc plates, which are soon corroded and destroyed, so, in the steam boilers, these deposits are also received by the copper at the expense of the boiler, which by necessity soon must be corroded and destroyed.

Quite recently (March 12, 1867) a patent was granted to Parry,

of Philadelphia, (No. 62,876,) in which he claims the use of the electricity developed by the friction of a steam jet when blowing from a boiler, like from a safety-valve, collecting this electricity outside the boiler by means of the metallic brush (usual for this purpose in the steam electric machine, invented some thirty years ago,) and communicating it to the shell.

There are, however, two reasons why this principle cannot be expected to work successfully. In the first place, we do not want the intensity currents—it is not friction electricity, or so called static electricity, which can determine the direction of deposits from liquids; but we want the quantity currents, developed by the simple evaporation, or by chemical action—the so-called dynamic electricity—which determines the direction of such deposits, and is used in electro-plating, etc. In the second place, these steam electric machines work never for any length of time satisfactorily, but the most perfect ones give out in a few hours, even sometimes in a few minutes, requiring to be stopped, regulated, re-arranged, cleaned or repaired, which defects have always been the objection to their introduction as generators of electricity, like every one knows who has ever been bothered with using them.

From the preceding account it is evident that the static electricity, which manifests itself alone by sudden discharges and sparks, (Parry's last patent,) is useless; also, that the galvanic electricity produced by two metals plunged in the same liquid (Webster and Young's patent) is injurious, as it not only prevents the incrustation, but dissolves the boiler itself (the remedy being worse than the disease.) What we want is a simple electric repulsion between the shell of the boiler and the particles of solid deposit, so that these are prevented from adhering to the boiler.

To settle this matter I made a series of experiments about the electricity of deposits, and found, by causing them to settle on a small metalic plate placed on the bottom of a porcelain evaporating dish, that most deposits are positive electric, which was ascertained by having an isolated wire attached to the plate, and this being connected with an electrometer, the last indicated positive electricity, when, after heating the dish, the liquid was left to cool and crystalize or deposit. The same facts were also proved by *Pouillet* in France, and recorded in the *Anales de Chimie et de Physique, second series, tome* xxxvi., *p.* 4.

When positive electricity was discharged from this metallic

plate into the liquid, in a gentle current, by proper means, the deposit or crystallization on it was effectively prevented.

The next step was only a verification of the old experiment, that vapor of water, containing certain salts in solution, is always positive electric; see Peltier in the above mentioned work, third series, *tome* iv., *p.* 1414; see also *Daguin Physique*, *tome* ii. *p.* 555.

All that we have to do, therefore, is to collect in the shell of the boiler this positive electricity of the steam, so that it can discharge in the water at every place where the boiler is in contact with water. The interior surface of the steam room of a boiler will not absorb the electricity of the steam, except when it is provided with points, or where, by cold, the steam is condensed against it, in exactly the same way as the metallic roof of a building will not absorb the electricity from the atmosphere which the pointed lightning rods will easily do, and thus protect the building, or which falling rain will also partially accomplish.

Consequently, I came to the conclusion that all that was practically wanted to prevent incrustations from forming, was simply to place in the steam room or steam-drum of the boiler a number of downward pointed lightning rods, which with their upper end form a metallic connection with the boiler. Those points will then absorb the positive electricity of the steam, communicate it to the shell of the boiler, from where it will naturally discharge in the water where this is in contact with it, and everywhere repel the electro positive deposits, so that these are continually prevented from settling, and kept in suspension in the water, and from time to time may be blown off like mud.

On this principle an application for patent was made, disclaiming every particular claimed by others, as well in theory as in practical arrangement; and the patent was granted February 12, 1867, No. 62,093, with the following disclaimer and claim:

"I disclaim any conductor suspended or not by isolated attachments. I disclaim a conductor armed at one end with steel points, magnetized or not magnetized—this being not only useless but absurd. But I

"Claim: The attachment within the upper part of the steam room of a boiler a number of short rods, resembling straight or curved lightning rods, or their equivalents, intended to carry the positive electricity of the steam to the bottom of the boiler, where it, discharging in the water, repels the electro-positive deposits,

preventing them from settling, and thus protects the boiler from incrustation."

From the discussion which followed, it was apparent that the members present thought many more experiments would be required to settle definitely the value of electricity in preventing incrustation.

H. F. Walling, Esq., presented the following paper, which was read by title:

THE MEASURE OF FORCE IN MOVING BODIES.

The determination of the quantity of force which is associated with a body in motion has engaged the attention of mathematicians and philosophers since the day of Newton and Leibnitz, who originated a remarkable controversy on the subject, which was energetically carried on for many years, and, indeed, seems not to be fully settled, even at the present time.

Although the positions taken by those celebrated disputants and their respective followers were widely different, it is to be observed that neither controverted the experimental and practical results obtained by the other.

Sir John Playfair, therefore, having given the subject most full and careful attention, sums up his history of the controversy by remarking that, "In reality, the two parties were not at issue on the question; their positions, though seeemingly opposite, were not contrary to one another; and after debating for nearly thirty years, they found out this to be the truth." Finding that the difference consisted in the definitions rather than in the facts it was quite generally decided, about the middle of the last century, that since force is the agent by which motion is produced, its quantity should be measured by the "*quantity of motion*" in the moving body, which is proportional in bodies of equal weights to the velocities of the bodies. In unequal bodies, the product of the mass into the velocity affords a means of comparison. This product is also called the *momentum* of a moving body.

On the other hand, several eminent men of the present day appear to advocate a reversal of this decision, and the adoption of the measure proposed by Leibnitz, called by him "*vis viva*" or *living force* of a moving body, namely, its mass into the *square* of its velocity. This question is by no means an unimportant one, and, upon its decision, many of the discoveries which are rapidly

being made in physical science, appear to have an important bearing.

Without expecting to add any essentially new ideas to those heretofore expressed, on a subject which has been so thoroughly discussed by the most profound thinkers, an attempt is made in this paper to simplify the presentation, if possible, of principles so important in every branch of mechanical and physical science, in order that the nature of the difference between the two measures may be clearly seen. At the same time a definition of the word *force* is proposed, which appears to involve the recognition of the Newtonian measure as the true one.

Let us, then, define force, in the most direct and obvious manner, as *that which causes matter to move*, and see to what conclusions we are thereby led. According to this definition we do not admit that force ever produces mere *tendency* to motion. On the contrary, motion *always takes place* when force acts upon matter.

Nor does the production by force, of "change of motion," whether by accelerating, retarding, or altering its direction, require a change in our definition, if we admit the principle, fully confirmed by experience, that *all motions are relative*, i. e., only to be known by referring them to the motions of other bodies, which motions must, in turn, be again referred to others since there is no known absolute point of rest. Any change of motion, therefore, is virtually a new motion in another direction. It obviously follows, from these premises, that equal increments or decrements of velocity, added to or taken from a moving body, are accompanied by equal increments or decrements to or from its force.

Suppose, for example, that two equal bodies move side by side, and that their velocities are equal, when referred to some object which we will suppose is a third body of equal weight assumed to be at rest. Relatively to each other the two bodies are at rest, and if we suppose the velocity of one of them to be doubled and then refer it to the other which is thus assumed to be at rest, we find that it sustains precisely the same relations to the other in regard to quantity of associated force that each of the two bodies did to the first object of reference. Its associated force must, therefore, be just doubled in quantity if we again assume that the first object of reference is at rest. In the same manner it may be shown that an increase or diminution in the velocity of a moving body in any proportion whatever, is accompanied by an increase

or diminution of the associated force in precisely the same proportion.

We accordingly find that gravity, which, at the surface of the earth, is considered to be virtually a uniformly acting force, at least for such comparatively small distances as fall under our observation, produces equal accelerations or retardations of velocity, in equal times. A falling body, freely acted upon by gravity, acquires twice the velocity in two seconds that it had at the end of the first; three times the velocity in three seconds, and so on for any number of seconds, until a distance is traveled which sensibly affects the force of the earth's gravity. The actual velocity at the end of the first second is about 32 feet; at the end of the second, 64 feet; at the end of the third, 96, etc.

Again, if two equal inelastic bodies, rigidly attached together, meet in space a third similar body, equal to each of them in weight, and moving in the opposite direction with twice their velocity, all three will be brought to rest, *i. e.*, the moving force of the latter just equals that of the two former. And so if any two unequal and inelastic bodies having the same momenta, *i. e.*, product of mass into velocity, meet in space while moving in opposite directions, they will be brought to rest.

This is in accordance with Newton's third law, namely: "That to every action there is always opposed an equal reaction; or the mutual actions of two bodies upon each other are always equal, and directed to contrary parts;" and the ratio of the quantity of force in a body to the quantity of its motion, or to the product of its weight into its simple velocity, is a corrollary of this law.*

Let us now examine the views and arguments of those who maintain that the force of a moving body is as the square of its velocity. Instead of the imparted velocity, another element of the effect of force has been introduced by them, as its proper measure, namely, the space through which the body acted upon is carried during the action. An unretarded moving body will continue to move forever, and will, therefore, pass over an infinite distance in

* I have attempted, in another paper read before the Polytechnic Association, to show that there is no actual contact, or rather no clashing of atoms in the collisions of bodies. (See page 818.) An explanation of the equality of action and reaction is offered, which is widely different from that usually given, and it is also shown that material atoms are detached from each other, movable and not impenetrable even, so that in the collisions of inelastic bodies, here cited, the force apparently lost, is retained among the atoms, increasing their relative motion among each other; in other words, their temperature. The mutual destruction of the motions of the bodies, as bodies or aggregations, however, is none the less a proof of the equality of the moving forces.

space. A retardation, which is simple the action of a force in the opposite direction to that of the moving body, causes in it a virtual motion in the opposite direction of constantly increasing velocity, until at last the two motions become equal, and the body is brought to rest for an instant.

On the other hand a body, whether at rest or in motion, if acted upon by an accelerating force for a definite period of time, moves through a greater space than it otherwise would, and the excess of distance so traversed is called the "effective space," and becomes the measure of "vis-viva," "living force," or "power of performing work," as it is variously called.

It is not difficult to see that the distance which a body will traverse, when accelerated from zero by a uniformly acting force, or retarded by such a force to zero, is proportional to the square of the terminal velocity in one case and of the initial velocity in the other.

For, we may suppose the units of time and of space as minute as we please, and such that during each unit of time, the increase of velocity is a unit of space. During the first unit of time the mean velocity will be one-half the unit of space, the initial velocity being 0, and the terminal velocity 1. For the second unit of time the mean velocity will be $1\frac{1}{2}$; for the third $2\frac{1}{2}$, etc.; and since these mean velocities measure the distance traversed during each unit of time, the spaces traversed during a succession of such units are as $\frac{1}{2}$, $1\frac{1}{2}$, $2\frac{1}{2}$, $3\frac{1}{2}$, etc., or clearing of fractions, as 1, 3, 5, 7, 9, etc. Comparing the total spaces traversed, we find them, as 1, $1+3=4$, $4+5=9$, $9+7=16$, etc., or as the squares of the times or of the terminal velocities. In the case of a *retardation* to zero, exactly the reverse takes place, and the spaces are proportional to the squares of the initial velocities.

The force, therefore, acquired by a falling body is capable of raising the same body to the exact height from which it fell. A body having twice the velocity of another, is capable of raising a weight four times as high, or it will raise four times as much weight to the same height as the other body.

It follows from the principle of the relativity of motion, already stated, that when a change of condition is effected, the effective space is to be computed in the same way as if the body were at rest at the commencement or termination of the change of condition. To determine it therefore, we have only to multiply the amount of the change in velocity by the time of its accomplish-

ment, and divide the product by two. The effective space as thus determined, is always proportional to the square of the difference in velocity effected.

The nature of the difference between the two measures of force is now apparent. One shows the actual condition of a body, as to rest or motion, and is proportional in bodies of equal weight to the *time* in which a uniformly acting force produces the acquired velocity. The other measures the *space* passed over while the velocity is being acquired. Either measures the change a body is capable of producing on another body *when estimated in units of its own kind.*

Now it happens that the spaces which bodies or atoms traverse, while under the influence of opposing forces, form the most practical mode of determining the magnitude of all the active operations of life. Thus the products of the labor of men and animals, as well as those of machinery of all kinds, consist entirely in results equivalent to the *raising of weights.* Indeed, considering the atoms of bodies as minute weights, this effect or product of "*work*" is universal. While, therefore, the unit of this power of producing *space effects* is a proper one for units of its own kind, we must, to avoid confusion, distinguish carefully between the *power of performing work and the moving force.*

Thus the compression or extension of a spring is "*work performed*" upon it, and the spring is capable of performing an equal amount of work in reaction, while regaining its original freedom from tension. So with the expansion of steam or of the gases produced by exploding gunpowder, &c. Their effects are space effects, and should be measured by units of their own kind. Most of the confusion of ideas apparent in the discussions of this subject, arise from attempting to measure a quantity or magnitude of one kind by the unit of another.

As a general conclusion, we find that a small force in a moving body is capable of doing a great deal of work, if the velocity of the body is very great; while on the other hand, a great force in a body so heavy that it has but little velocity, does but comparatively little work. The converse of this is also true. In giving the same momentum to a light body and a heavy one, more coils of a spring are required for the former than for the latter, and the same amount of work will give more momentum to a heavy body than a lighter one—a principle exemplified in the employment of fly wheels to store up force.

In two bodies having equal quantities of associated force or momentum, the *vis-viva* or power of performing work will be in inverse proportion to the weights of the bodies. For, since the ratio of velocity increases inversely with the weight, we have the square of the inverse ratio divided by the simple ratio, which gives the simple inverse ratio of the weights for the proportion between the two living forces.

Adjourned.

ANNUAL EXHIBITIONS OF THE AMERICAN INSTITUTE.

EXTRACT FROM THE BY-LAWS OF THE AMERICAN INSTITUTE RELATING TO ANNUAL EXHIBITIONS.

ARTICLE X.

DUTIES OF THE BOARD OF MANAGERS.

SECTION 1. The board of managers shall organize by appointing a chairman and vice-chairman from their own number, and a secretary; and after such organization, if it is decided to hold a fair, they shall be entitled to the services of the corresponding secretary of the Institute in preparing circlars and conducting the preliminary correspondence relating to the exhibition, and the clerk of the Institute shall act as their principal clerk, and be in constant attendance during such exhibition.

§ 2. There shall be held in the autumn of each year, unless otherwise ordered by the Institute, a fair, in the city of New York, under the direction of the board of managers, embracing an exhibition of the products of agriculture, manufactures, commerce, and the arts of the United States. The said board may hold, in connection with the fair, a show of live stock whenever they shall deem it expedient; they shall also have the power to make, or cause to be made, a comparative test of ploughs, mowers, reapers, diggers, and other agricultural implements, by putting them into practical operation in the vicinity of the city of New York. They shall further be empowered to examine or cause to be examined any manufacturing process or heavy machinery in operation which it would be impracticable to exhibit within the limits of the fair.

§ 3. Whenever the building and grounds occupied by the Institute for the annual exhibition are sufficiently extensive to warrant the accommodation of specimens and products of industry from all the States in the Union, the board of managers shall have

the power of appointing one of more honorary members from each State, whose especial duty it shall be to give information regarding the fair, to such of its citizens as may desire to become exhibitors thereat.

§ 4. Whenever the Institute shall authorize any special exhibition of vegetables, fruit, flowers, or of specimens of mechanical or chemical skill and ingenuity other than at autumnal fairs, the same shall be held under the direction of the board of managers.

§ 5. The first duty of the board of managers, after it has been decided to hold a fair, shall be to issue a circular inviting all inventors and proprietors of machines, manufactures, works of art, and all cultivators of agricultural and horticultural products, to exhibit the same, setting forth the advantages to be derived from such exhibitions. In order to explain the arrangements and extent of the several departments, they shall also publish in such circular the classification in section 6, which shall be adhered to as far as the room occupied by the fair will allow, in the distribution of space, and in the location of the articles received for exhibition.

§ 6. Classification at the annual exhibition.

I.—*Department of Fine Arts and Education.*

1st *Group.* Paintings on canvas, glass, and other surfaces; pastels, cartoons, miniatures.

2d *Group.* Engravings, lithographs, chemical etchings, plain and colored, enamel work, designs and drawings relating to architecture and civil engineering.

3d *Group.* Photographs, plain and colored, daguerreotypes, ambrotypes. All other impressions by the action of light.

4th *Group.* Sculpture, cameos, medals, medallions, bas relief, embossed work, fine castings in bronze, zinc, and other metals.

5th *Group.* Musical instruments—pianos, organs, melodeons, instruments used in bands and concerts.

6th *Group.* Specimens of printing and bookbinding, stationery, globes, maps, charts, and all apparatus for instructing in science, tables and machines for calculation.

7th *Group.* Philosophical instruments, mathematical and measuring instruments, dials, chronometers, watches and clocks, telescopes, microscopes, lenses, cameras and other optical instruments, excepting those to be carried in the pocket.

II.—*Department of the Dwelling.*

1st *Group.* Apparatus for warming, lighting, cooling and ventilating cooking-stoves, ranges and refrigerators.

2d *Group.* Kitchen ware and utensils, machines and implements for washing and preparing clothes.

3d *Group.* Carpets, oil cloths, matting, paper hangings and tapestry.

4th *Group.* Cabinet furniture—mirrors, upholstery and room conveniences. Writing desks, ornamental safes.

5th *Group.* Table furniture—cutlery, castors; glass, porcelain, silver and other ware used for holding food and condiments.

6th *Group.* Ornaments for the dwelling house, excepting those embraced in the first department. Billiard tables, chessmen and boards, contrivances for in-door recreation and amusement.

7th *Group.* Building accessories and permanent attachments. Doors, window-sash, blinds, mantels, grates, stairs, encaustic tiles and other specimens of flooring, timber frames, cut and cast ornaments for the outside of dwellings, plumbers' work, water closet, apparatus and baths, bells, door-springs, locks, latches, bolts, hinges, screws, nails, and other household hardware, useful and ornamental articles for the grounds surrounding the dwelling.

III.—*Department of Dress and Handicraft.*

1st *Group.* Apparel for ladies—hats, bonnets, dresses, hose, boots and shoes, gloves, shawls, cloaks, mantillas, manufactured furs.

2d *Group.* Apparel for gentlemen—hats, caps, coats, vests, pantaloons, shoes, boots, gloves, overcoats, cloaks, undergarments, furs.

3d *Group.* Cloths of wool, cotton and silk; all other fabrics, woven, knit, or felt; ribbon, cords, tassels, thread, buttons, pins, and other materials used in combination with cloth for dresses.

4th *Group.* Hand implements used by ladies in manufacturing dress—sewing machines, knitting machines, needles, thimbles, scissors, etc.

5th *Group*. Specimens of dentistry, artificial limbs, wigs and hair-work, surgical apparatus and surgical instruments, spectacles and opera glasses.

6th *Group*. Jewelry and ornaments for the person; attachments used in out-door sports — skates, fishing tackle, hunting and shooting apparatus ; gymnastic implements, and toys for children.

7th *Group*. Trunks, carpet bags, reticules, traveling cases, pocket books, razors, pocket knives, pocket pens, pencils, umbrellas, parasols, and hand implements not elsewhere enumerated.

IV.—*Department of Chemistry and Mineralogy.*

1st *Group*. Soaps, toilet preparations, candles, oils, wax, resins, and other hydro-carbon compounds.

2d *Group*. Acids, alkalies, other chemical bases, salts, artificial fertilizers, soda water and apparatus for making it, mineral waters, wines, beverages and stimulants, excluding so-called patent medicines.

3d *Group*. Leather, skins, peltry, furs, parchment, specimens of taxidermy, catgut, goldbeaters' skins, membrane preparations, tobacco, cigars and snuff.

4th *Group*.. India rubber and gutta percha preparations, artificial stones, crucibles, cements, prepared materials for roofing, and specimens of brick.

5th *Group*. Paints, dye-stuffs, inks; specimens of dyed yarns, tissues, and other colored substances, and specimens of bleaching.

6th *Group*. Samples of baking and pastry cooking, sugars, confectionery, prepared condiments, sweetmeats, preserved fruit, vegetables and meats, condensed fluids and extracts used in preparing beverages.

7th *Group*. Specimens of natural stones used in building, minerals, ores, metals, alloys, apparatus used in chemical works, implements of the laboratory, stills, condensers, heaters, apparatus for making gas, and machines for expediting chemical changes.

V.—*Department of Engines and Machinery.*

1st *Group*. Stationary engines driven by steam, heated air and other gases, water engines and water wheels, and all other prime movers.

2d *Group.* Pumping machinery, steam fire engines, and other engines for moving fluids.

3d *Group.* Machinery for working metals—lathes, planers, screw cutting machinery, drills.

4th *Group.* Machinery for working in wood—saws, planing machines, boring machines, machines for mortising and tenoning.

5th *Group.* Machinery for preparing fibres and tissues, and machinery used in the manufacture of cloth.

6th *Group.* Machinery and tools used in the manufacture of leather, India rubber, porcelain, pottery, bricks, and materials used in the arts not before specified.

7th *Group.* Gearing, millwork, and elements of machinery for varying speed or power, and all tools used by artisans or in factories not otherwise provided for.

VI.—*Department of Intercommunication.*

1st *Group.* Locomotive engines, cars, and all apparatus used in constructing and operating railways, models of bridges, etc.

2d *Group.* Carriages, wagons, sleighs, and all vehicles drawn by animal power; harness, saddles, bridles, and all apparatus used in connection with the horse and the stable; and all improvements connected with common roads.

3d *Group.* Models of vessels for navigating the ocean, rivers, lakes and canals; all apparatus connected with building, propelling and steering vessels; models of locks, docks, aqueducts; structures and implements used in navigation.

4th *Group.* Electric telegraphs, apparatus used in constructing telegraph lines; implements and contrivances used in transporting and distributing mails; package express and implements connected therewith; all apparatus for giving signals and alarms, bells, etc.

5th *Group.* Machinery, implements and materials used in printing and engraving.

6th *Group.* Implements for expediting trade, contrivances used in the store and warehouse; scales, safes, hoisting apparatus, shutters, vault lights, reflectors, and iron columns.

7th *Group.* Army apparatus used in movements or in camp; guns, pistols, swords; plans for permanent fortifications. All attachments, articles and devices for schools, churches and public works not elsewhere designated.

VII.—*Department of Agriculture and Horticulture.*

1st *Group.* Specimens of plants and flowers.

2d *Group.* Fruits, vegetables, cereals, roots and seeds.

3d *Group.* Specimens of food prepared on the farm—butter, cheese, etc.

4th *Group.* Ploughs, diggers, cultivators, harrows, drain pipes and implements used in preparing the soil; pruning knives, and all implements for cultivating plants and trees; hot house apparatus.

5th *Group.* Mowers, reapers, scythes, and implements used in gathering the products of the soil; threshing machines, corn shellers and grain mills.

6th *Group.* Churns, cheese presses, and all articles used in dairy, farm house, and farm stable, not elsewhere enumerated.

7th *Group.* Specimens of products of the soil used in the arts—wool, hemp, flax, cotton; specimens of animal growth—wool, silk, hair, feathers, down, horn, bone; live animals, whenever the board of managers decide to admit them.

§ 7. It shall be the further duty of said managers, after the publication of such circular, to select and appoint competent persons to act as judges in the several departments as to the comparative merits of articles on exhibition, but not to decide upon the kind of premium to be awarded; to notify such persons of their appointment, and in case of any one declining to act as a judge, to supply the vacancy. Printed blanks shall be prepared by the Institute for all exhibitions, to aid the judges in the performance of their duties, so that they can briefly express their opinion upon thee following points:

The general merit of the class under examination.

The best article exhibited, and whether the same is better than any other used for the same purpose, known to them and not on exhibition.

The articles of the second and third order of merit.

The reason upon which their conclusions in each case are based.

§ 8. Should it be ascertained after the commencement of the fair that any exhibitor is connected either by near consanguinity or business relations with one of the judges, in the department or class in which he is an exhibitor, it shall be the duty of the managers to substitute another judge.

§ 9. The judges shall be notified to meet at a particular hour and place, within the limits of the exhibition, and the Board of Managers shall select one or more persons to meet such judges, provide them with blanks, with a list of the articles to be examined, point out the location of the same, and extend to them the requisite facilities for a thorough and impartial performance of their duties.

§ 10. The decisions of the judges as to the order of merit of competing articles shall be binding upon the said Board in the distribution of premiums, and in no instance shall an award be made upon their own volition. If, however, it shall satisfactorily appear that any article has not, for sufficient cause, received that consideration which its merits seemed to require, it shall be the duty of the Board to cause a re-examination before a final decision shall be made; and in case it can be shown that any decision is the result of fraud and collusion, or from the obvious incompetency of the judges, or in violation of any by-law of the Institute, the same may be set aside or altered by a vote of two-thirds of the managers present at any regular meeting of the Board.

§ 11. No premium, or anything in lieu thereof, shall be awarded by the Board of Managers, directly or indirectly, to any of their members, or any of their employees, or to any judge appointed by them, or to any member of other standing committees, or to any trustee of the Institute, or to any person or company who shall employ as agent either of the officers and members aforesaid.

§ 12. The kind of premium to be awarded to the exhibitor of the best articles in any department shall be decided by a majority of the Board, and they shall so award premiums of less value to lesser grades of merits respectively.

§ 13. All medals shall be made of bronze. The highest prize at any exhibition shall be the large medal of honor, which shall be given only for a new and useful invention, or for a new and highly valuable product of the soil, never before exhibited. This prize shall be awarded only to the originator of such invention or product.

§ 14. The large medal of honor, designating the highest prize,

shall not be awarded by the managers for any article unless its practical value shall exceed that of any similar one in use, known to them, or intended to accomplish the same purpose.

§ 15. The regular premiums of the exhibition shall be awarded to the inventor, manufacturer or producer, in preference to the owner or exhibitor of any article, and shall be as follows :

First premium. First medal, and a diploma containing the reasons in full which governed the judges in rendering their decision.

Second premium. Second medal, and diploma containing an explanation of the merits of the article, and the points of utility as presented by the judges.

Third premium. Third medal, and a certificate of the relative value of the article exhibited, as given in the judges' report.

§ 16. The Board of Managers shall have sole power to admit or exclude articles presented for exhibition, and to remove any article already admitted they may deem objectionable.

§ 17. No charge shall be made for space.

§ 18. In all cases where materials or work and labor are required, involving an expenditure of an amount exceeding ten dollars, it shall be the duty of the manager or committee having the same in charge to reduce the agreement to writing, which shall be executed by the party thereto, before purchase shall be made or the employment begin.

§ 19. No member of the Board of Managers shall take, or be interested directly or remotely in, any contract, or do any work ordered to be done by them, or any of their sub-committees, for which any charge shall be made or compensation given.

§ 20. Any individual desiring to become a member of the Institute, during the time of holding the annual fair, may make an application, similar to that provided for in Art. XXI, sec. 1, to the Board of Managers. Such application shall also be endorsed by a member of the Board. A quorum of the Board shall be required to act upon the same. If the applicant is admitted by them, he shall, on the payment of five dollars, receive a member's free ticket to the fair. At the next meeting of the Institute after the fair, the Board of Managers shall report the name, residence and occupation of such individual, and by whom endorsed, and the meeting shall thereafter act upon the said report, as upon applications made for membership, provided for in Art. XXI.

§ 21. The Board of Managers shall deposit daily the money received by them from the sale of admission tickets, and from all

other sources, in the bank in which the funds of the Institute are kept, and to its credit, to be drawn out only by order of said Board.

§ 22. The Board of Managers shall report to the Institute, at its first meeting after the close of the fair, the amount of money received and deposited by them, the amount disbursed, an estimate of the expenses by them incurred, and the amount of money on hand; they shall immediately thereafter pay to the Treasurer of the Institute all the proceeds of the fair over and above such estimates. As soon thereafter as all their receipts and expenditures can be definitely ascertained, the Board of Managers shall present a detailed statement of the same, accompanied with vouchers, to the finance committee for their examination, and after the same shall be endorsed as correct by said committee, the said Board shall make a full report of their proceedings to the Institute, on or before the annual meeting, and pay over to the Treasurer all the moneys remaining in their hands. And if any bills for expenditures at the said fair, not in violation of any by-law, remain unpaid, the Treasurer shall pay the same, after they shall have been audited by the Board of Managers and said finance committee.

INDEX.

A.

B.

T.

U.

V.

ERRATA.

Page 471, for "quartermores" and "quarternions."

Page 661, 15th line, for "aerial" read "axial."

Page 662, 30th line, for "Mars" read "Uranus."

Page 664, 1st line, for "therefore" read "heretofore;" in 10th line for "on" read "over."

Page 719, 9th line, for "Wolft" read "Wolff."

Page 720, 5th line from the bottom, after "how" add "the velocity of light by means of the eclipses of the moons of."

Page 721, 4th line, for "fitted" read "filled."

Page 725, 8th line from the bottom, for "orator" read "author."

Page 811, 6th line from the bottom, for "indentity" read "identity."

Page 813, 9th line, for "portions" read "positions."